METAL INDUSTRY

23 MAY 1958

The Plant Engineer

STANDING upon the threshold of a second industrial revolution, as indeed we are, it was no doubt most appropriate that the theme of the recent annual conference of the Incorporated Plant Engineers should have been the "Exploitation of Change". For something like a century this country was rightly deemed the workshop of the world; we gained our supremacy in the 19th century because we excelled in engineering genius and were the first to develop mechanical power on a large scale for manufacturing and transport purposes. In his Presidential address to the conference Mr. K. S. London, stressed the fact that conditions today were very different. Other nations, who have had their technical men trained in Britain, have profited by the lessons they learned from us and have entered the markets of the world in competition with us. This state of affairs is bound to continue and is likely to become intensified as more and more nations seek to raise their standard of living by industrialization. In these circumstances, if our own standard of living is to be maintained, much will depend on our ability to speedily recognize change and to adapt ourselves to it.

Dealing with the position of the plant engineer in industry, Mr. London pointed out that over 95 per cent of all manufacturing establishments in this country employ less than 250 men; many of these may have at the most one professional engineer (which term does not include tradesmen or their supervisors) essential to keep the wheels turning. It is this state of affairs which has given rise to a widespread, but mistaken, impression that plant engineers are just maintenance men—supervisors of repair and modification. Consideration of this industrial picture is incomplete, said Mr. London, without recognition of the fact that over 50 per cent of the total manpower in our manufacturing establishments is in firms employing over 500 men. In such concerns one engineer cannot be expected to keep the plant running by himself, he needs other engineers to help him, and according to the nature of the plant those who assist him may be specialists in civil, mechanical, electrical, or instrument engineering.

A committee which investigated the scope of plant engineers' responsibilities came to the conclusion that, while there can be no clear-cut definition, in general terms a plant or works engineer is one whose combination of education, training, and experience has fitted him to take technical or executive responsibility in engineering research or development, or in the design or specification of new equipment; in the manufacture or installation of new plant, or in the maintenance or modification of existing plant—whether fixed or mobile. The phrase "the combination of education, training, and experience" was used to indicate that competent engineers can be produced by appropriate combinations of these three ingredients. In certain circumstances, the training that a man can get, plus the right experience over a period of years, can largely compensate for a lack of higher academic qualification. It was unanimously agreed that a plant engineer is a manager in his own right, able to control his staff administratively and technically. It would therefore seem reasonable to predict that in the automatic factory of the future those next in importance to the managing director will be the sales manager and the plant or works engineer on whose organization will depend the economic functioning of the plant. A tremendous responsibility rests on these three.

Out of the MELTING POT

Bit by Bit

ROTARY forging is a process developed in Austria and recently taken up with much enthusiasm in America. As the name implies, the work is rotated while the forging is done by a number of co-operating rapidly-reciprocating suitably-shaped die elements, which act upon the appropriate portions of the surface of the workpiece. For the present purpose, greater detail is not necessary. It is sufficient to note that the basic principle of the rotary forging process falls into line with an interesting trend in the development of processes of working metals:—the trend towards working bit-by-bit; in other words, dealing with a relatively small portion of the work at a time instead of doing the job, or trying to do the job, at one go with the expenditure of an enormous amount of brute force and with the use of massive equipment. This reference to a trend may call forth the rejoinder: "What trend?" Nascent trends are difficult to detect but the pleasure, and, indeed, the reward, of having detected one tend to be all the greater. The reward usually accrues from the developments to which a trend, once detected, is likely to point. Take rolling, for example. Our trend would reverse the persistent striving for more and more massive mills capable of giving the largest possible reductions per pass at higher and higher speeds. Possibly increasing the latter, the trend to work bit-by-bit would content itself with reductions of the order of, say, 0·5 per cent per pass, or even less. This might well have some interesting effects on the properties of the rolled product. At the same time, it would undoubtedly open up new avenues to developments in rolling mill design. The possibilities of a corresponding trend might also be considered in wire drawing. Would there be any benefit to be derived from a decrease in the drawing force if the reduction per pass were to be reduced to really small values; and what about die wear? Looking, as it were, in the opposite direction, what would be the consequences of the introduction of the bit-by-bit trend into casting practice?

Not So Simple

ACCORDING to the generally accepted view, one way of making a fortune is to discover and take up the manufacture of some new product, or to undertake to perform some widely needed service. Even nowadays this view still holds good, and given the basic premise, and because of certain features of the system of taxation, it is still possible, starting more or less from scratch, to build up a business worth a sum that could never be accumulated by life-long employment even at a substantial salary. While the direct aspects of this state of affairs are sufficiently familiar, much less attention seems to have been paid, and certainly far fewer conclusions have been arrived at, regarding its remoter circumstances. One of these concerns the difficulty of hitting upon, or in some way or another discovering, the basic brilliant idea on which the whole subsequent development is founded. What ultimately becomes a large demand for a new product or service is originally either inarticulate or non-existent. Indeed, on those occasions when demands for particular products or services are expressed, they usually prove to be either very limited in scope or to arise from an ignorance of the fact that the products or services are already available. Another of these circumstances is the comparative ease with which the product or service, once it has been discovered, can be made available. It seems as if, given the right product or service, one can hardly go wrong. Putting these circumstances together, would it be true to say that the difficulty in making a fortune is not much more than the difficulty of thinking of something (product or service) that is easy to supply? Conversely, is everything for which the need is easy to discover, difficult or impossible to supply? Is there, in other words, an inverse relation between the obviousness of a demand and the ease with which it can be met?

Wider View

AS more information about the ultrasonic welding process becomes available, the more one realizes the risk it runs of suffering from a too early specialization. In its present form, ultrasonic welding roughly corresponds to electrical resistance spot and seam welding, except that instead of electrical energy, vibrational (ultrasonic) energy is introduced into the joint. Like electrical resistance welding, ultrasonic welding can be of the individual spot type or of the continuous seam type for which roller type welders are used, with which speeds up to 20 ft/sec. have been achieved. Mechanical ingenuity has led to applications which enable, for example, the welding of spiral ribs on the outside of cylindrical rods or tubes, and the welding of the troughs of a corrugated sheet to a flat sheet or plate. Then there are the special applications in which ultrasonic welding excels: the joining of parts of widely differing thickness, and the welding together of dissimilar metals. The risk of a too early specialization would appear to derive from the present lack of complete understanding of the mechanism of ultrasonic welding. The vibrational energy introduced into the weld is known to cause a considerable rise in temperature: 400°-600°F. in the case of aluminium sheet, 1,000°F. in Monel-aluminium combinations, and over 1,800°F. in a titanium alloy. No ordinary macroscopic melting has, however, been observed in ultrasonic welds. Another phenomenon at the joints is the considerable amount of interfacial deformation (up to 60 per cent) that occurs, without, however, any indentation or other deformation of the surface. The interfacial deformation is particularly marked when joining materials of about the same hardness, and is readily observed when the materials are dissimilar. To avoid over-specialization, further studies of the mechanism of ultrasonic welding should extend to the possibilities of broadening the conditions and introducing further variables. If, for example, the temperatures developed in the welds are essential, must all the heat be generated by the ultrasonic energy? Could not some of this heating or preheating be done by the passage of an electric current, without, however, ultrasonic welding becoming electrical resistance welding? In another direction, ultrasonic welding must clearly link up with hot pressure welding at a point where the vibrational energy has been reduced to zero, while the temperature and pressure have been raised to those values required for pressure welding. On the more mechanical side, consideration might be given to the possibility of increasing the area of the welds by a "scanning" or "wiping" motion that would result in a progressive welding of large areas of contact.

Skimmer

Works Visits

The A.P.V. Company Limited

By L. R. PARKES

(*Concluded from* METAL INDUSTRY, 9 *May* 1958)

Complete processing assemblies under construction in the fitting shop at the Crawley Works

VERY close supervision is maintained at all stages of fabrication, the inspection being under the charge of a superintendent, who has the assistance of four foremen and two chargehands. In addition, there are a number of fully skilled inspectors.

In order to meet the continually growing demand for very high welding standards, radiographic inspection of vessels is virtually part of routine, and two mobile units are constantly in operation in the fabrication shops. They are a 100 kV Philips X-ray unit and a 150 kV unit capable of radiographing steel up to 1 in. thick. The latter unit is of the "rod anode" type and will project X-rays through 360°, so that it is possible to place film over the entire area of a circumferential seam and expose it all in a single shot. The time saved by this type of equipment is considerable.

Routine checks on material analyses are carried out in a central metallurgical laboratory which is also responsible, in conjunction with the development engineers for the introduction of new alloys and methods of assembly. In fact, with the very rapid increase in the amount of quality control demanded the laboratory is becoming more and more a part of the productive machine.

Engineering Shops

To the west of the fabrication bays are the engineering shops, which comprise machine, press and fitting shops in five 475 ft. bays, with stores and works offices taking up a portion of the south end. These shops are equipped for the production of plate type heat-exchangers, pumps, pipe fittings, and various other items of equipment requiring engineering processes. By far the largest percentage of work produced in these bays is in stainless steel. The machine shop covers two acres and is equipped with modern machine tools of all kinds, including five Wickman automatics and a number of Herbert semi-automatic machines for repetition work. For the production of mild steel components, end plates, flanges, etc., an automatic British Oxygen triple head profile cutter is employed. The machine operates with coal gas and oxygen, and will flame-cut blanks up to 8 in. thick. Using propane or acetylene, the thickness can be increased to 12 in., the three cutting heads operating simultaneously or individually as required.

Adjacent to the machine shop is the press shop, housing eight hydraulic presses to a maximum size of 750 tons. These presses are principally engaged in the production of Paraflow heat-exchanger plates in stainless steel.

The fitting shop—a 60 ft. wide bay, served by two 15 ton cranes—deals with the assembly and instrumentation of dairy, brewery and food processing plant, and also the assembly of complete installations which The A.P.V. Company provide in their capacity as process engineers.

Ancillary to the fabrication and engineering sections of the works are 26,000 ft² of floor space, occupied by packers, scourers, painters, press tool stores, plate shop and power hammers. The mechanical hammers, of which there are two, are part of the fabrication division but are separately housed in an annexe at the northern end of the fabrication shops to reduce disturbance to other workers. The larger of the two hammers has a capacity for forming domes up to 14 ft. diameter.

Research and Development

To further its four main types of production, The A.P.V. Company maintain an extensive research and development organization, some £50,000 to £100,000 a year being spent on its work, which is carried on in a 21,450 ft² building at the eastern end of the Crawley site. The whole of the first floor is occupied by laboratories, while the ground floor is devoted to mechanical and radiographic testing, development and testing of prototypes, and apprentice training.

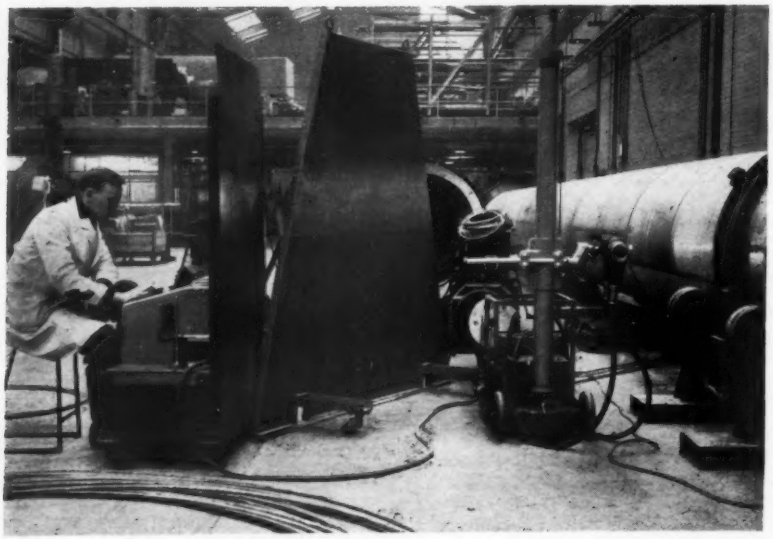
The main responsibilities of the metallurgical and welding research department are welding, fabrication and routine foundry work for the subsidiary foundry company of A.P.V.-Paramount Ltd. It is generally concerned with the testing of, and research into, metals and alloys. The rooms under its control are an Izod test room and tensile test room on the ground floor, and a metallurgical laboratory, welding laboratory and furnace room on the first floor.

The Izod machine is used for testing the resistance of stainless steel and other alloys to controlled impacts at varying temperatures down to that of liquid air (−180°C.). Other equipment includes a Vickers diamond pyramid hardness tester and a 50 ton Denison tensile machine.

The metallographic room is provided with all the modern equipment needed for preparation of specimens for microscopic examination under a Vickers projection microscope.

The furnace room has two furnaces —a Birlec unit capable of heating up to 1,200°C. and a Johnson Matthey

Welding a 6 in. thick ring in 99·5 per cent pure aluminium for a swimming pool type reactor core tank



Philips mobile 100kV X-ray unit in operation

platinum/rhodium wound furnace for temperatures up to 1,350°C.

In the welding laboratory, the relations between welding techniques and weld structures and properties are studied, several types of welding machine being retained for these studies. Fundamental work on the physics of the welding arc, using a cathode ray oscillograph, is also carried on here.

Radiographic Department

The responsibility of the radiographic department lies in the routine ray examination of castings and sections. It is equipped with a Philips 300 kV X-ray set with a Müller tube, and will detect flaws in steels up to 4 in. thick. A 250 micro-curies radioactive cobalt isotope provides a gamma ray source for further examinations. This is housed in a specially shielded cubicle, the door-fastening mechanism of which is interlocked with the isotope unit so that the radioactive source cannot be exposed while the door is open, and vice versa.

The laboratories of interest are the corrosion research laboratory, concerned with the diagnosis and solution of corrosion problems in industrial plant, and the analytical laboratory, responsible for routine check analyses of melts made in the foundries of A.P.V.-Paramount Ltd. Estimations are, in the case of stainless steels, primarily for carbon, sulphur, chromium, nickel, molybdenum, manganese, silicon, phosphorus, niobium, titanium, and copper. For aluminium and copper alloys, the work is mostly colorimetric, and is carried out on a Spekker absorptiometer.

The whole picture of A.P.V. is one of continued expansion, particularly into new and unusual fields of welded fabrication. Within the three years that the fabricating shops have been in operation at Crawley, welders, polishers, fitters and machinists have all had to adjust themselves to new requirements and new techniques. The activities of the A.P.V. welding school have been intensified, and radiography of test plates has now become part of its routine. The amount of weld testing, both on plates taken from the shops and in connection with qualification tests for operators has increased considerably as, indeed, has the degree of control over all incoming materials. The very stringent demands now being made by the industries which the company serves permit nothing short of a complete and intimate understanding both of materials used and of the latest fabricating techniques.

Chromium Plating

A CHROMIUM-IRON alloy plating bath that produces hard, bright plate with abrasion resistance and a crack system very similar to conventional chromium plate has been developed at Battelle Memorial Institute, according to a report by D.S.I.R. The crack system makes possible the use of this bath in porous chromium plating but prevents its use where complete corrosion protection of the basic metal is required. This trivalent-chromium bath is amenable to alloying additions, and a 94 per cent chromium-6 per cent iron alloy plate retains its hardness at considerably higher temperatures than does unalloyed chromium plate. In addition, the trivalent bath can be formulated and operated to yield a crack-free plate which provides excellent protective qualities.

An improved process for plating matte-type chromium iron alloys which provides good corrosion protection has also been developed.

Large Galvanizing Line

WITH reference to the article in our issue of 2 May describing the new galvanizing line at the Ebbw Vale works of Richard Thomas and Baldwins Limited, it should be noted that The Head Wrightson Machine Company Limited were responsible for the complete engineering and manufacture of this equipment, as main contractors to Richard Thomas and Baldwins Limited, and that the flame cleaning, annealing and galvanizing furnaces, together with the atmosphere generating plant, were supplied by Birlec Limited as subcontractors.

Research Laboratories

British Aluminium Company Ltd: Gerrards Cross

(Concluded from METAL INDUSTRY, 9 *May* 1958)

EQUIPPED to provide a wide range of exposure conditions such as those experienced in marine, industrial, tropical, and chemical plant conditions, the main corrosion laboratory has available various methods of assessment, to be chosen according to the type of application involved. Field and service tests in marine, industrial and rural atmospheres, and in sea water and soils, are also controlled from these laboratories, and include specimens which have now been exposed for over 20 years. Facilities for research on the application of paints and chemical conversion coatings are usually developed as required for specific problems.

Work on stress corrosion is concentrated mainly on steels in hot caustic soda solutions, and on the high strength aluminium-magnesium-zinc alloys in salt spray. The former originated in problems arising in the company's alumina works[26] and represents one of the most important of the problems on corrosion of the company's plant and buildings under investigation in these laboratories. The stress corrosion behaviour of aluminium-magnesium-zinc alloys has become more important through the tendencies in the aircraft industry to machine or etch off the protective cladding from plate, and to apply significant stresses in the short transverse direction of plate and extrusions, which is by far the worst direction with respect to stress corrosion as well as ductility.

The results of laboratory field and service tests of interest to builders and architects were given to the S.C.I. 1957 Symposium[27] and in particular demonstrated the wide range of applications where appropriate aluminium alloys correctly erected can be used without protection or maintenance.

The group is also actively concerned with finishes on aluminium; lacquering and enamelling are but two of those under regular study.

The increasing use of aluminium alloys in shipbuilding has shown how, with experience, many of the traditional problems of corrosion and paint maintenance can be overcome, but bimetallic contacts, and particularly aluminium-steel contacts, are liable to cause trouble unless suitably designed and maintained; work is, therefore, proceeding on new methods of making such joints to give the designer wider scope and to minimize maintenance.

Work is nearing completion on the improvement of tappings designed to connect stranded aluminium and stranded copper conductors. These laboratories have also played a major part in the introduction of internal greasing of stranded aluminium conductors, with or without a galvanized steel core, to prevent the corrosion which sometimes occurs on coastal lines. The bitumen previously used for the purpose was shown to be harmful rather than beneficial, due to its deterioration after exposure for a few years.

Frequently changing conditions make it necessary to keep under regular review and investigation the effects of production procedure, metal composition, and other variables on colour, corrosion resistance, or the amenability of the product to protective coatings, so that immediate action can be taken where needed.

Anodic Laboratories

The company has always played a leading part in the development of special grades of metal for anodizing and allied applications, and, as a natural corollary, has maintained an anodic department whose purpose it has been to inspect and test the various types of anodic quality metal, and also to investigate and develop methods of anodizing.

The value and scope of the work of this group is indicated by the number of patents published during the last quarter of a century, in particular that covering the Brytal process[28] for the electrolytic brightening of high purity metal, and, more recently, those covering processes for the continuous anodic treatment of wire.[29] In addition, work of a more theoretical nature has been carried out, much of it being published.

In July, 1957, the research work of the group was largely transferred to Chalfont Park, leaving the metal testing and larger-scale development work at Warrington. The new laboratory is equipped with tanks in PVC, stainless steel, and mild steel, for anodizing and dipping processes, including bright dipping. Aluminium rinse tanks are situated between each pair of treatment tanks, which are ventilated by lip-axis extraction ducts at front and rear. Three sources of current, A.C. and low- and high-voltage D.C., can be switched to any of the anodizing tanks. The installation is thus readily adaptable to a wide variety of methods of treatment. A full complement of test gear for the non-destructive measurement of the physical properties of anodic films is also available.

The field of investigation covers the development of brightening methods, coloured finishes for architectural applications, and fundamental studies of the brightening and anodizing processes. Larger-scale development work at Warrington is devoted to further improvements in the continuous anodizing of wire and strip.

Operational Research

The Mathematics and Operational Research Group is tackling a wide range of production, planning, and commercial problems. Statistical techniques have been used by the company in the design and interpretation of both

A stage in the development of apparatus for investigating atomic absorption spectroscopy

works and laboratory experiments since the early 1930s. In recent years, an increasing awareness of the need to apply these methods to many of the broader problems arising in the works, and in connection with related commercial activities, has led to the formation and growth of this group.

The application of quality control techniques to the various stages of the Bayer process has proved efficacious. In the extraction stage, in which the alumina in bauxite is dissolved under pressure in strong caustic soda, a 7 per cent gain in output was achieved with no increase in running costs. The tighter control leading to this gain is governed by less sampling and testing than had previously been thought necessary.

Soda is an undesirable impurity in alumina, and for many years it was believed that the soda content could be reduced only at the expense of output. A statistical analysis of operational works' data led to a quantitative determination of the factors controlling soda content, and a subsequent laboratory scale investigation enabled the research laboratories to devise a method of producing low soda alumina without lowering output.

In the reduction process, the life of the electrolytic cells in which the oxide is reduced to metal is a major economic factor. Life expectation and survival curves have been derived to facilitate forward estimation of material and labour requirements. A detailed study of the factors determining cell life has also been made, and much useful information derived.

One of the company's hydro-electric systems has a restricted water storage capacity, so that there tends to be water loss by spilling in winter followed by water shortage in the dry summer months. The system has been simulated by a mathematical model, which is now being used to determine what changes could most advantageously be made to the storage system and how best to link power usage to water availability for maximum overall efficiency.

In metal fabrication processes, cost of production is largely determined by the extent to which the recovery of saleable product is reduced by process scrappage and rejections. A technique, whereby recovery targets are set throughout the process and feed-back via statistical control charts is introduced to ensure that the targets are met, has been developed and proved to be satisfactory. Concurrently with this work, statistical analysis of production data has led to an evaluation of the effects of process variables on scrap and rejection losses, and this information has been used to alter process conditions to improve performance.

Analytical Services and Research

The analytical laboratories are responsible for the chemical analytical work required in connection with all the work proceeding in the research laboratories, and with the technical services offered by the company's sales division.

The bulk of the samples are metallic, but many are of non-standard composition. In others, there is special interest in the less common elements often present only in minute traces. Hence, it is constantly necessary to devise new processes or modify existing ones to meet special needs. Non-metallic samples include bauxite and other aluminous ores, alumina, electrode materials used in the reduction process, and building materials, foodstuffs and lacquers, with which aluminium and its alloys are associated in building construction, transportation and packaging.

The group also analyses samples requiring special methods on behalf of the company's factories, and assists in maintaining the standards of accuracy of the company's routine laboratories by organizing the regular exchange of samples, keeping statistical control charts, distributing standardized samples for calibration and reference, and modifying existing and devising new analytical techniques.

A technique which has proved of the greatest value is the separation of volatile metals such as magnesium, zinc, and sodium by vacuum distillation at 900°C. as a preliminary to determination by an established method. The method is effective for determining alloying quantities of magnesium and zinc, and is invaluable for determining minute traces, since extremely large sample weights can be taken and a clean separation made from the aluminium in a single operation.

The development of a method for the dissolution of calcined alumina in hydrochloric acid under pressure by heating in a sealed glass tube, has enabled the determination of soda, iron, lime, sulphate and boron to be carried out rapidly and with virtually no blank contamination.

A double beam flame photometer has been developed for the determination of soda in alumina, hydrate and kier muds after hydrochloric acid dissolution, and in metal after separation of the sodium by vacuum distillation. The instrument has also been used for the determination of potassium in metal and lithium in cryolite fluxes.

Recently developed photometric methods include the determination of iron in metal and alumina using 1:10 phenanthroline; niobium using thiocyanate; niobium and tantalum using pyrogallol; phosphorus and vanadium in liquors as the complex molybdates; and silica in alumina by reduction of the molybdate colour with 1-amino-2-naphthol-4-sulphonic acid.

Ion exchange resins have been proved useful for the removal of cations prior to the determination of boron, removal of aluminium in the photometric determination of sulphate, and in the separation of aluminium and phosphate in the analysis of sludges from the Brytal process.

Instrumentation

In the Instrumentation Group, the accent is on non-destructive examination and testing, and two groups of methods are employed, one based on the use of ultrasonics and one on eddy currents. Ultrasonic testing is used to examine aluminium plate, rolling blocks and extrusion billets to check their homogeneity and soundness. Several pieces of apparatus used for eddy current testing have been made in the laboratory and are used for a variety of investigations. The main uses are for the detection of weak welds in aluminium tube produced by the bridge die process, and for the identification and sorting of aluminium alloys by measurement of their electrical conductivity. Similar principles have been applied to the detection of hairline cracks in ferrous and non-ferrous materials, and to the measurement of the thickness of anodic films and paint and lacquer films on aluminium.

Work on spectrography is divided between supplementing the services of the chemical analytical group and investigating new or modified techniques. Of recent years several direct reading spectrometers, two of American, one of French and one of British manufacture, have been installed in the company's routine laboratories.

Much of the initial experimental work connected with these instruments called for a considerable effort, especially on the form of sample needed to give accurate and consistent analytical results, on the provision of standards, and in establishing the accuracy on a statistical basis.

Particular attention is being paid to the analysis of solutions and powders, and to Walsh's new technique of atomic absorption spectroscopy. The latter is a complete break with conventional emission spectroscopy. Narrow spectrum lines of low energy and of a given element are excited in a special discharge lamp, and passed through the vapour of the material to be analysed, where they suffer absorption. The extent of absorption is a measure of the amount of the element present. Theoretically, the method offers promise of a higher order of accuracy than is attainable in emission spectrography, and interference by one element on the determination of another should be much less significant.

References

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[27] E. W. Skerrey and E. H. Laithwaite; *J. Appl. Chem.*, 1957, **7** (5), 216.

[28] A. N. D. Pullen; Brit. Pat. 449,162, 1934.

[29] J. T. Richmond and A. N. D. Pullen; Brit. Pat. 573.983, 1945; A. N. D. Pullen; Brit. Pat. 599,188, 1948.

Institute of British Foundrymen

Annual General Meeting

FOR the fifty-fifth annual general meeting, members of the Institute of British Foundrymen met at the Pavilion Gardens, Buxton, on Wednesday, May 14, the retiring President, **Mr. J. Blakiston,** being in the chair.

The Annual Report of the Council for the session 1957-58 was adopted, on the proposal of the chairman, seconded by **Mr. H. J. V. Williams** (past-president), there being no discussion.

In the absence of Mr. N. P. Newman (hon. treasurer), who was abroad, **Mr. J. G. Bailes** proposed the adoption of the balance sheet, **Mr. John Bell** (past-president), seconding.

The balance sheet and accounts were adopted.

Presenting the Technical Council's report, **Mr. M. M. Hallett** submitted that the Technical Council, working on behalf of the Institute, was covering the whole field of the industry, dealing particularly with those points on which it was felt the average member wanted guidance in difficult circumstances.

The adoption of the Technical Council's report was seconded by **Dr. D. V. Atterton** and carried.

Presentation of Awards

The President presented the **E. J. Fox Medal** to **Mr. P. A. Russell,** in recognition of the outstanding contributions in both technical and other spheres he had made to the progress of the foundry industry.

In recognition of his contributions to foundry technology, and also in appreciation of his great services to the Technical Council, the chairman presented the **Oliver Stubbs Medal** to **Mr. M. M. Hallett.**

There were two awards of the **Meritorious Service Medal** for 1958.

One was to **Mr. G. D. Thompson,** in recognition of the extremely valuable services he had rendered to the Australian (Victoria) branch of the Institute for so many years.

The second award was to **Mr. Vincent Delport,** in recognition of his great services to the Institute for many years in the national and international fields.

A. E. Peace

C. H. Wilson

G. R. Shotton

The President said that all were well aware of the continuous loyal service Mr. Delport had given to the Institute, and it was very unfortunate and regrettable that he was seriously ill and could not attend the conference.

The **British Foundry Medal** and the British Foundry Prize of £10 were presented to **Mr. C. H. Hicks,** in recognition of the excellence of his Paper, "The Manufacture of Aircraft Engine Castings."

Awards of Diplomas were announced as follow: **Mr. Ivor Rees** and **Mr. D. H. Snelson,** for their Paper "Aids to Production in a Jobbing Foundry; **Mr. J. Jarvis,** for his Paper, "Ultrasonics in the Foundry"; **Mr. F. Gaiger,** for his Paper, "Methods Engineering, with Emphasis on Flow Process Control Applied to Fettling Shops."

Election of Officers

Proposing **Mr. A. E. Peace** be elected President of the Institute for the forthcoming year, the chairman said that there could be no doubt that Mr. Peace would carry out the difficult duties of the Presidency most ably, and that he was the right man to control the destinies of the Institute during the forthcoming year.

Seconding, **Mr. J. W. Gardom** (past-president and formerly chairman of the Technical Council) said that over many years of "metallurgical acquaintance" and of collaboration with Mr. Peace in technical work, they had come to know each other very well, and he had every confidence in seconding the proposal.

Mr. Peace was duly elected and acclaimed, and was invested by Mr. Blakiston with the Presidential badge of office.

Expressing his appreciation of the very great honour conferred upon him, Mr. Peace said that he accepted the responsibilities of his high office with the desire to serve the members well and to follow worthily the many fine Presidents they had had.

He then presented to Mr. Blakiston a past-president's badge and asked him to continue to preside over the meeting.

On the proposition of **Mr. H. J. V. Williams,** seconded by **Mr. J. Vickers, Mr. C. H. Wilson** was elected to the office of senior vice-president and invested with his badge of office.

Mr. S. H. Russell (past-president) proposed that **Mr. G. R. Shotton** be elected junior vice-president, and **Dr. J. E. Hurst** (past-president) seconded.

Mr. Shotton was duly elected and invested with his badge of office.

Members of Council

The election of five members of council was announced as follow:—**Mr. H. Hall, Mr. M. M. Hallett, Mr. J. Hill, Mr. R. F. Horton, Mr. P. A. Russell.**

A vote of thanks to the retiring President was proposed by the President and endorsed by **Mr. C. J. Dadswell** (past-president).

The resolution was carried with acclamation.

Mr. Blakiston thanked the meeting for their expressions of appreciation.

Mr. Kenneth Marshall (director,

P. A. Russell

M. M. Hallett

G. D. Thompson

Vincent Delport

C. H. Hicks

Joint Iron Council) said he had been deeply touched to hear that Mr. Delport was very ill. He asked that a message be sent from the conference to assure Mr. Delport that his many friends there were thinking about him.

Mr. A. E. Peace then presented his Presidential Address.

The President then introduced **Prof. A. J. Murphy,** who delivered his lecture entitled "Metallurgy and Aeronautical Progress."

Annual Banquet

On Wednesday evening, May 14, the Institute's Annual Banquet was held at the Pavilion. Following the Loyal Toast, the toast of "The Corporation of Buxton" was proposed by **Mr. J. Blakiston,** his Worship the Mayor of Buxton (**Coun. J. Bootherstone**) responding. "The Institute of British Foundrymen" was proposed by **Lord Hives** and acknowledged by **Mr. A. E. Peace.** The senior vice-president, **Mr. C. H. Wilson,** proposed the toast of the guests, to which **Mr. C. R. Wheeler** replied.

The banquet was followed by dancing.

Mr. J. Blakiston investing Mr. A. E. Peace with the Presidential badge

Mr. and Mrs. P. A. Russell, Mr. John Bell

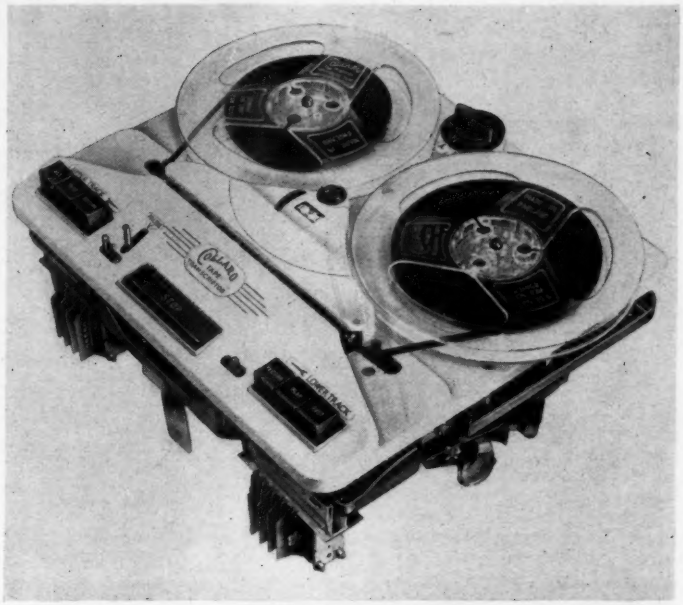
Mr. and Mrs. Kenneth Marshall, Mr. and Mrs. G. E. Lunt, Mr. and Mrs. Arnold Carr

Mrs. A. B. Everest, The Mayor of Buxton, Mrs. J. Blakiston, The Mayoress of Buxton, Mr. J. Blakiston, Mrs. A. E. Peace, Mr. A. E. Peace, Mr. J. Bell

Guests being received at the civic reception

Pressure Die-Casting Review

Die-Cast Tape Recorder



The Collaro tape transcriptor, an assembly that uses a number of interesting die-castings

FEW products have enjoyed the post-war popularity that has come the way of the tape recorder and the record player. In almost every country of the Western world this boom has occurred, and, particularly among young people, the possession and playing of one of these instruments has become as important as was, in earlier days, the playing of tennis. Coincident with this boom has been the development of the microgroove record and the very specialized high fidelity equipment used to amplify recordings from both tape and discs. Clearly, with this immense demand for better reproduction at the amplifying stage, there has been a corresponding need to improve performance of the tape transcriptor and the record player, for, whether the recording is one of Tommy Steele or Stravinsky, the critical ear insists on the maximum frequency range, undistorted and free from motor whine, record scratch and other extraneous noise.

Extreme accuracy has, therefore, become of prime importance in the manufacture of the mechanical parts of this type of equipment, and accuracy has had to be combined with high production rates and efficient and economical processes. Such a combination leads naturally to the consideration of pressure die-casting for

Fig. 1—The chassis of the tape transcriptor, showing the top side of the casting

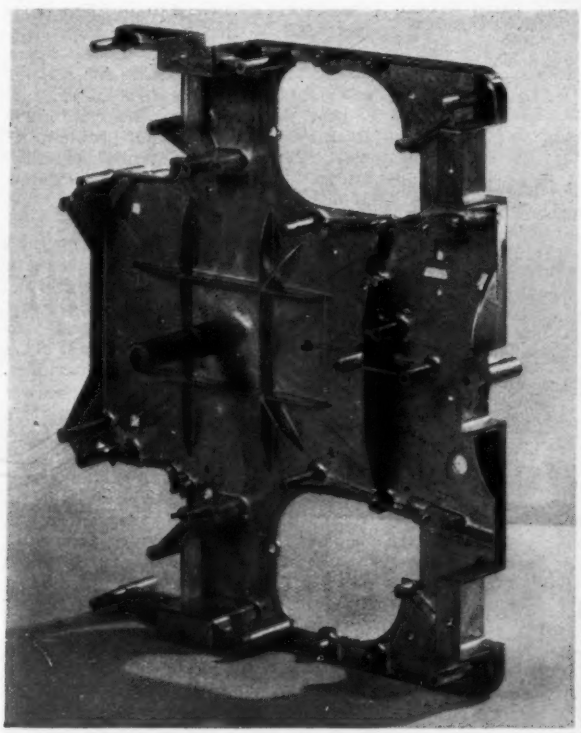
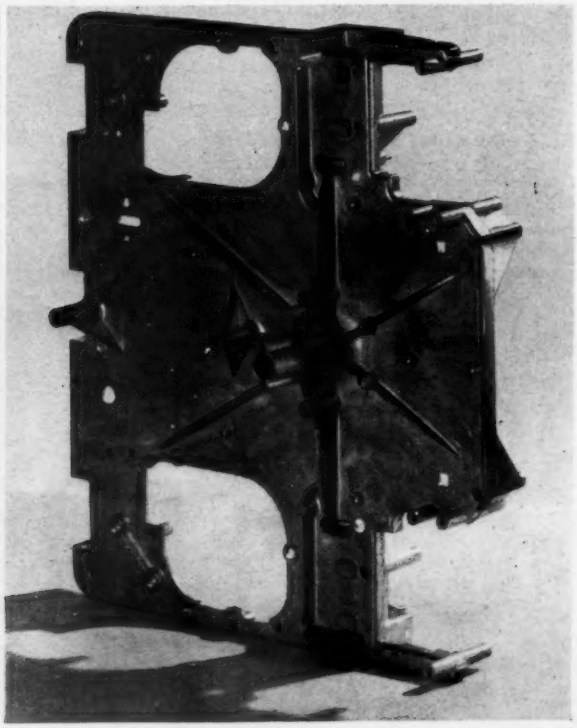


Fig. 2—The underside of the zinc alloy casting for the tape transcriptor chassis



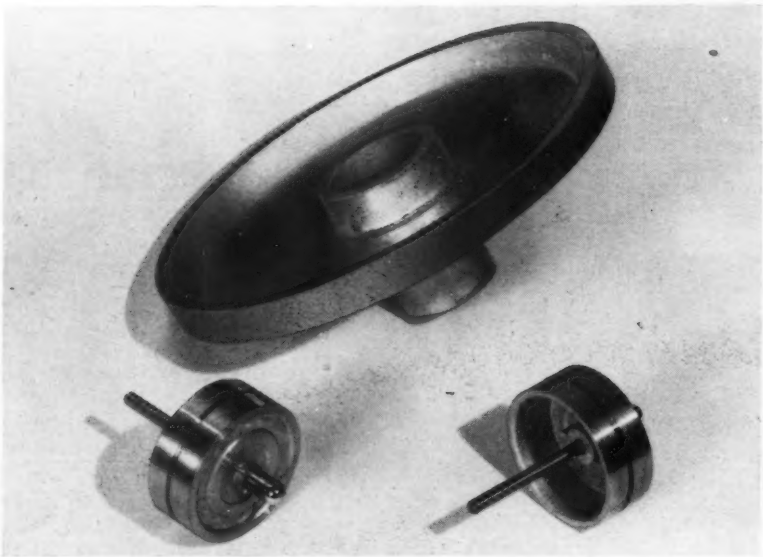


Fig. 3—The flywheel and spool carriers

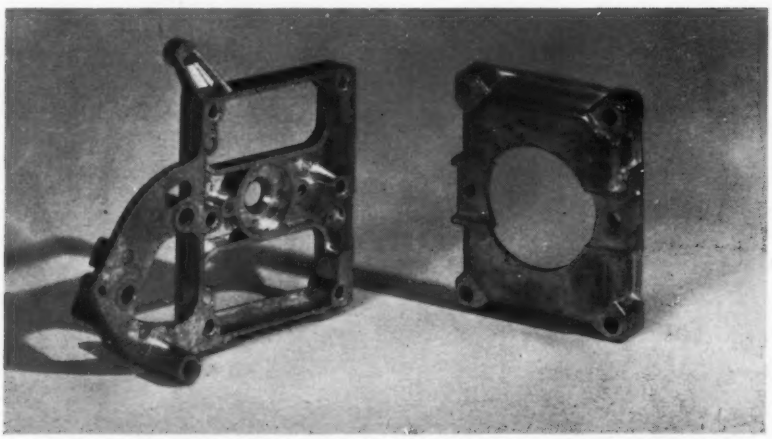
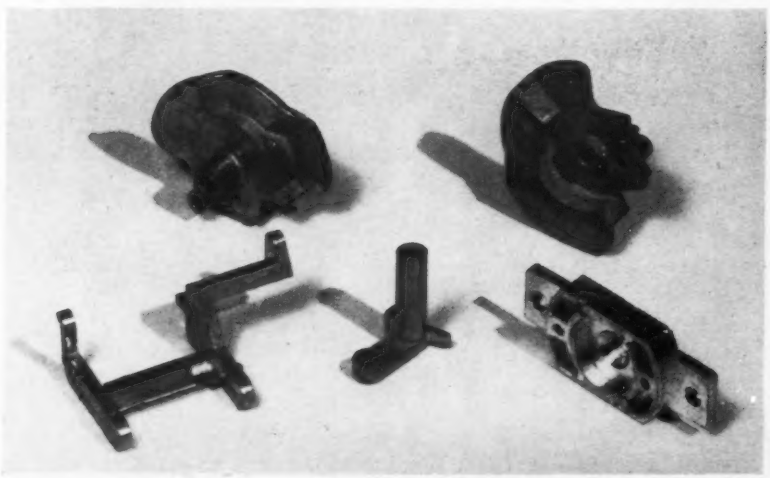


Fig. 4—The top and bottom motor brackets

Fig. 5—The lower bearing bracket (bottom right), idler lift lever (centre), idler swivel bracket (bottom left), and three-speed cams



as many components as possible, and in one of the highest grade tape recorders on the market, that made by Collaro Limited, of Ripple Works, By-Pass Road, Barking, Essex, pressure die-castings in zinc alloy are extensively used. Some of these die-castings are illustrated and described in this article, and a subsequent one will deal with those used in the Collaro "Conquest" record changer.

The most important casting, and one which splendidly exemplifies how die-casting assists production, is the chassis of the tape transcription unit, shown in Figs. 1 and 2. As illustrated, this casting is unmachined, all the detail shown being incorporated in the die-casting as it leaves the die. It is $12\frac{3}{4}$ in. long $\times$ $11\frac{1}{4}$ in. wide, and it forms the basis of the whole assembly. Upon it are fitted the two motors, flywheel, spool carriers, switches, and all the complex electrical equipment necessary for high fidelity recording and playback.

This casting has over 70 holes on its upper side and about 40 further cored holes on its underside. Some of these are cleaned up before assembly, but the majority remain as they are or serve as tapping holes. The main boss is bushed and reamed, and finally lapped. As will be seen, full opportunity has been taken of the facility offered by die-casting for the inclusion of bosses and location points for other components. It will be noted that the raised rectangular platforms, which support the top cover of the assembly, have been recessed on their underside to maintain constant wall thickness, and, incidentally, to minimize weight. A further design point of interest is the provision of webs that radiate from the base of the larger bosses, thus adding rigidity to the component and at the same time assisting the flow of metal to the boss cavities in the die.

In a casting of this size and relatively thin section, the problem of ejection presents a number of difficulties if severe distortion is to be avoided. Ejector pin marks are visible on the underside of the casting, and the importance of their placing may be judged; there are 50 on the flat face and eight operating against bosses. Other features on the underside include cast-in hexagonal recesses to accommodate bolt heads, several blind holes and irregularly-shaped apertures.

Feeding a casting with a projected area as large as this, necessitates close attention to heat distribution throughout the die, as well as the avoidance of unduly sharp changes of section. Not much choice is left to the designer in the positioning of the sprue, and it will be seen from Fig. 1 that the feed point has been placed opposite to the main boss, the sprue still being attached to the upper end of this boss.

The three castings in Fig. 3 are the flywheel and two spool carriers. The flywheel is the large casting, being a heavy section wheel, dished on its underside, and having a cast-in

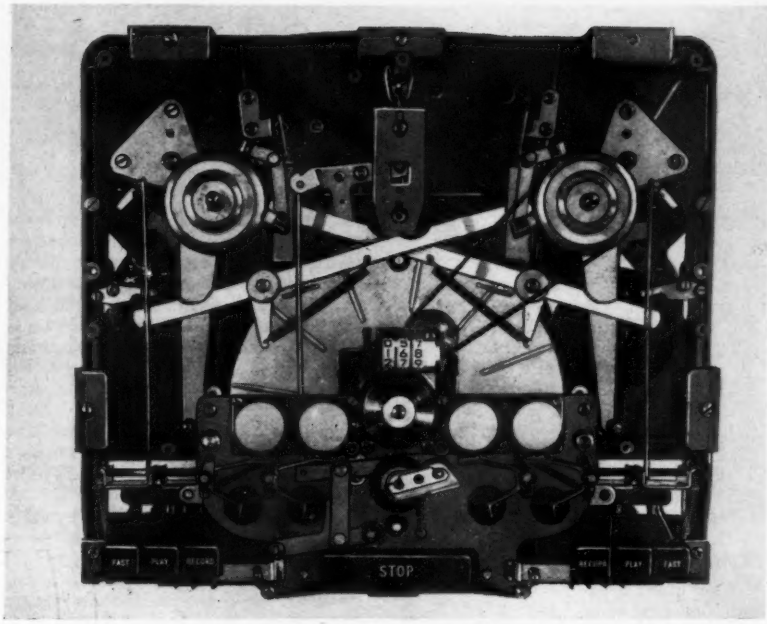


Fig. 6—Top view of the chassis assembly for the Collaro tape transcriptor

bearing bush in the centre bore. Since much of the smooth running of the tape transcription unit depends upon the balance and accuracy of this flywheel, the bore is reamed and the perimeter is machined to a concentricity of 0·0005 in. Similarly, the outside diameters of the two spool carriers are machined to close limits after a hardened and ground spindle has been pressed into the centre bore.

A number of die-castings are used in the motor unit assembly and some of these are shown in Figs. 4 and 5. The two castings in Fig. 4 form the top and bottom motor brackets, and each has a number of cored holes and recesses. Fixing lugs are incorporated in the castings and very little machining is done on these components prior to assembly.

In Fig. 5 are the lower bearing bracket, idler lift lever, idler swivel brackets and the three-speed cam. The lower bearing bracket forms the housing for the lower end of the motor spindle and has two cored fixing holes and two dowel holes, as well as the bearing recess at the centre. The three-speed cam on the right has a flange formed into three steps, which position the idler pulley assembly on a triple cone drive to provide the correct speed. The two other castings shown in this illustration also form part of the idler assembly.

No elaboration is needed to explain how difficult would be the mass production of parts like these if conventional castings were resorted to, or if sub-assemblies of pressed or machined components were put in their place. The illustrations show the complexity of the castings, and Fig. 6, which shows a chassis assembly from the upper side, gives an idea of the number of parts which have to be fitted to the chassis casting. No process at present in use combines so well as pressure die-casting all the facilities required for the manufacture of this type of instrument — speed of production, minimum machining, negligible metal loss, accuracy, stability and rigidity.

Men and Metals

Elected President of The Institute of Fuel for the ensuing year, **Mr. T. C. Bailey** has been associated with the oil industry during his business life. For many years he devoted his attention to the application of fuel oil to industrial furnaces, and in 1954 was appointed sales manager (industrial fuels) of Shell-Mex and B.P. Limited.

In succession to the late Mr. W. B. H. Gallwey, **Mr. Thomas F. W. Jackson** has been appointed chairman and managing director of Union Carbide Limited. He is also a director of Gemec Limited, Bakelite Limited, and British Acheson Electrodes Limited.

A two weeks' intensive tour of Canada has been undertaken by **Mr. John G. Gershon,** sales director of Rocol Limited. The object of this tour is to establish Rocol selling agents, and during his tour Mr. Gershon will visit Montreal, Vancouver and Toronto.

It is learned from Thompson Bros. (Bilston) Limited that **Mr. E. E. Pheasey,** M.B.E., has been appointed works director to the company. Mr. Pheasey was previously with Foster, Yates and Thom.

Executive director in charge of export sales, Simmonds Aerocessories Limited and Firth Cleveland Instruments Limited, **Mr. A. P. H. Pehrson** is to visit Belgium and Germany this month, and will take the opportunity of visiting his companies' agents in those countries.

At the annual general meeting of the Society of Instrument Technology, held on Tuesday last, **Mr. P. Goudime,** M.A., President of The Scientific Instrument Manufacturers' Association of Great Britain Limited, presented the Bowen Prize to **Mr. S. T. Lunt,** B.A., for his Paper on "Process Development and Plant Design—the Role of Instrumentation with Particular Reference to the Application of Computers."

In succession to **Viscount Chandos, Mr. Thomas Johnston,** C.H., LL.D., J.P., chairman of the North of Scotland Hydro-Electric Board has been appointed President of the British Electrical Development Association. **Lt.-Col. E. H. E. Woodward,** C.B.E., M.C., T.D., B.Sc., M.I.E.E., has been appointed a vice-president of the association, and **Mr. W. N. C. Clinch,** M.I.E.E., Controller, Eastern Division, Central Electricity Generating Board, has been elected chairman of the E.D.A. Council for the year 1958-59. **Mr. T. E. Daniel,** M.Eng., M.I.E.E., A.M.I.Mech.E., chairman of the North-Western Electricity Board, has been elected vice-chairman of the Council.

It has been announced by the Board of Trade that **Mr. R. Wood** has been appointed Controller of the Export Licensing Branch in succession to **Mr. R. L. Elkington,** C.B.E., who is retiring.

At the annual meeting of the Birmingham Metallurgical Society, to be held next week, it will be announced in the Council's report that **Dr. R. King,** Ph.D., B.Sc., A.R.I.C., A.I.M., has been elected President of the society for the ensuing year. The vice-presidents elected for the period are **Mr. F. T. Longman,** A.R.I.C., A.I.M.; **Mr. H. M. Bigford,** F.I.M.; **Mr. S. G. Temple,** M.Sc., A.I.M., and **Dr. W. Steven,** Ph.D., B.Sc., F.I.M.

Appointed chairman of the Advisory Council on Scientific Research and Technical Development, Ministry of Supply, **Professor J. L. M. Morrison,** D.Sc., M.I.Mech.E., is Professor of Mechanical Engineering in the University of Bristol. He succeeds Sir Eric Rideal, who has been chairman of the Council since 1953.

Research Progress

Creep of Pre-Strained Aluminium

BY RECORDER

THE creep characteristics of a material are markedly dependent on the previous history of the sample; in particular, heat-treatments or straining processes can not only alter the magnitude of subsequent creep effects but may alter completely their form. Thus, for conditions under which a normal strain-free sample would show a transient creep stage followed by steady flow, an initial pre-strain might eliminate entirely the transient effect and steady-state flow would predominate from the start of the test. It has been demonstrated, however, that for some metals at any rate, e.g. lead, alloy steel, the improvement in creep properties is obtained only when the amount of pre-strain is limited to fairly low values: high pre-strains can, in fact, cause a deterioration in creep performance. An optimum pre-strain can thus be found at which resistance to subsequent creep will be at a maximum. The value of this pre-strain depends markedly on the temperature at which the creep stressing is applied, decreasing in magnitude as that temperature is raised.

Recrystallization Effects

The effects described above are often masked by a further process, recrystallization, that can also influence creep performance. The atomic transfers that occur as recrystallization proceeds, apparently give rise to small moving volumes of disordered structure in which flow can occur if the material is under stress. It is thus possible to account for the experimental observation that recrystallization occurring during creep accelerates considerably the rate of deformation. Since recrystallization might be expected to occur more readily in material pre-strained before test than in annealed samples, the effect of pre-strain in removing transient creep might be counterbalanced by an acceleration of creep due to recrystallization. These competing influences probably give rise to the existence of an optimum pre-strain for improved creep strength in several different metals and alloys.

It has been found, however, that the above processes may be further complicated in the creep of aluminium owing to the replacement of the normal type of recrystallization by a stress-recovery mechanism that leads to the formation of a stable sub-structure. A rather complex dependence of creep strength on creep stress was reported by G. R. Wilms[1] who found that if specimens of high-purity aluminium were pre-strained 5 per cent, the recrystallization occurring under zero load at 350°C. was inhibited if a creep load of 250 lb/in^2 was imposed on the specimen. At a creep load of 150 lb/in^2, however, recrystallization occurred in a shorter time than when no load was applied. The results could, perhaps, be explained as being, first, an effect of increasing strain in reducing the time required for recrystallization to occur, and secondly, a replacement of recrystallization as the mode of relieving stress by the sub-structure formation mechanism.

X-Ray Examination

The change in the stress recovery process is of some interest, and J. H. Auld, R. I. Garrod and T. R. Thomson, of the Aeronautical Research Laboratories, Melbourne, have recently carried out experiments very similar to those of Wilms so as to study the effect in more detail.[2] Specimens $\frac{1}{16}$ in × $\frac{1}{8}$ in. section with a gauge length of $1\frac{1}{8}$ in. were prepared from 99·99 per cent purity aluminium sheet. After annealing, the samples were pre-strained 5 per cent, electropolished, and then tested in creep under various loads at 350°C. The tests were interrupted at frequent intervals and the specimen cooled to room temperature for examination by both metallographic and X-ray techniques. By the latter method (divergent beam Laue using a micro-focus X-ray tube), it was possible to examine the whole of both sides of the specimen in four exposures and it was said to give "a very sensitive index for the onset of recrystallization." Thus, the pre-strained samples gave a pattern of blurred, almost continuous, arcs, which on "annealing" changed gradually to arcs of numerous discrete spots and then to short lines containing a relatively low number of spots.

At zero load at 350°C., the sequence of changes in X-ray pattern commenced after a very short time at temperature, but after 90-100 hr. a further effect could be noted on the X-ray photographs. This was the development of grains larger than those originally present in the material. Nucleation and growth of such grains occurred over a period, but the recrystallization process was substantially complete after about 350 hr. The initial formation of spots and the break-up of the arcs of the X-ray pattern are attributed to the development of a "more perfect" substructure, i.e. to a rearrangement into blocks, of the more heavily distorted parts of the structure.

When creep loads were applied, similar effects were obtained at most stresses, though at 225 and 250 lb/in^2, the last stage—recrystallization into a new matrix—was completely inhibited in agreement with the results of Wilms. At lower stresses, e.g. 150 lb/in^2, however, it was found that recrystallization was delayed slightly (relative to the time taken at zero load) and recrystallized grains were not observed until after about 130 hr. at temperature. This is contrary to Wilms' observations that recrystallization occurred more rapidly at 150 lb/in^2 than at zero load. Work at intermediate stresses, by Auld *et al*, showed that the effect of stress appeared always to be to delay the onset of recrystallization: at stresses of 150 lb/in^2 or less the incubation time was not greatly different from that at zero load, but this time then increased rapidly as the stress was raised further. Apart from the influence of stress on recrystallization proper, it was found also that the growth of the sub-structure prior to recrystallization was accelerated by increasing stress, a trend noted by Wilms.

Interpretation of Results

Auld and his colleagues suggest that the discrepancies between their results and those of Wilms are due not to anomalies when creep loads of 150 lb/in^2 are applied, but to a difference in the observations relating to the recrystallization behaviour of specimens held at 350°C. under zero load. They dismiss the possibility that the discrepancies are caused by differences in the sensitivities of the X-ray methods used in the two investigations, mainly because the agreement obtained under creep loads is satisfactory. An examination of the two sets of results indicates, however, that the explanation may lie, in part at any rate, in a confusion between sub-structure formation and the onset of recrystallization, and also in defining recrystallization in terms of time. Thus, Auld *et al* state that recrystallization apparently commenced in a pre-strained sample held at 350°C. under zero load after 90-100 hr., being "virtually complete" after 350 hr. Wilms, on the other hand, does not present any evidence about the start of recrystallization (although it might be inferred from his remarks that none had occurred after 120 hr.), but shows that considerable recrystallization had occurred after 265 hr. The presentation of Wilms' results by Auld and his co-workers makes it appear that the incubation time of 90-100 hr. which

(*Continued on page* 434)

New Plant & Equipment

Welding Aluminium

KNOWN as the CPU 350, a compact and mobile unit for use with the Argonaut welding process is said to provide maximum productive efficiency when used in connection with the A.C. welding of aluminium and its alloys up to $\frac{3}{8}$ in. in thickness in a single pass, and the welding of stainless steel up to $\frac{1}{8}$ in. in thickness.

A remote control foot switch, coupled with automatic arc starting and control of both argon and water, enable welding speed to be increased. After the unit has been switched off, the electrode cools in the protecting argon envelope, the gas continuing to flow automatically for a predetermined period. This results in economy of gas and ensures that the cleanliness of the electrode is maintained.

The unit incorporates surge injection, which is the introduction into the arc of a D.C. pulse, timed to coincide with the beginning of the oxide scavenging positive half cycle only. It is of sufficient magnitude to cause the arc to ignite immediately, and thus provides a full positive half cycle.

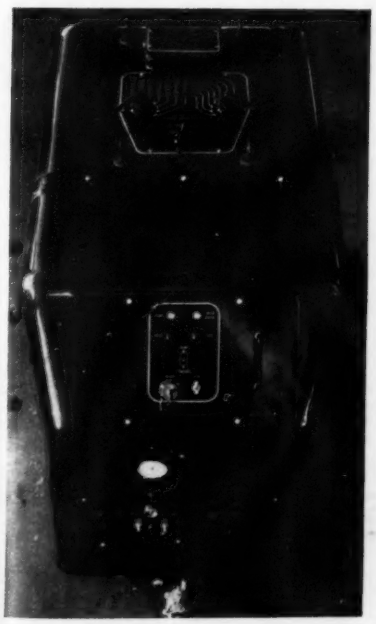
Surge injection allows a substantial reduction of open circuit voltage, resulting in a lower transformer rating, together with a reduction in the amount of current taken from the mains.

Since the H.F. starting spark is only present at the start of the welding operation, radio and television interference is confined to this period, and is entirely eliminated during actual welding.

With the D.C. suppressor unit, an equal positive and negative half cycle of welding current is ensured, giving welds which are clean and bright.

The composite power unit, a product of British Oxygen Gases Ltd. (Industrial Division), Spencer House, St. James's, London, S.W.1, is suitable for 360-500 V., 50 cycle, single-phase operation, with a striking voltage of 50 volts. Rating is 10·75 kVA continuous or 17·5 kVA at 0·5 duty cycle. Welding current is 25 to 350 amp., and 215 amp. continuous.

The British Oxygen CPU 350 composite power unit for Argonaut welding

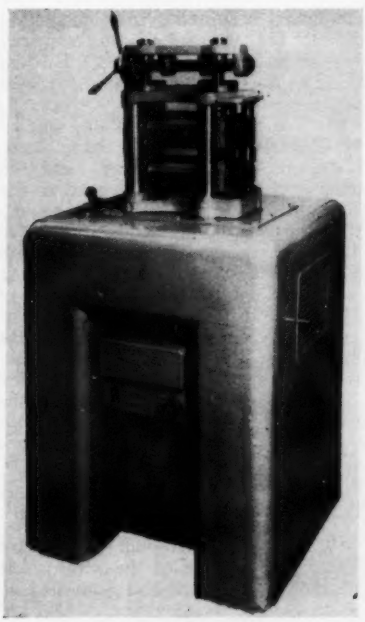


Strip Rolling

DESIGNED to incorporate solid robustness with compact appearance, a small 2-high rolling mill, manufactured by Abrams Engineering, Waterloo Road, Manchester, 8, is of particular interest to the sheet metal trades, electronics and precious metals industries, lead strip rollers, etc. A patented worm and wheel arrangement ensures a high and constant efficiency of individual drive to each roll, and for any width of roll opening. High-grade alloy steel rolls are heat-treated to be capable of rolling a wide range of materials.

The 3 h.p. motor, driving through a reduction box, will give sufficient power at a speed fast enough for a high rate of production, but at the same time slow enough to ensure ease of control.

Small 2-high strip mill manufactured by Abrams Engineering



The new filter for plating solutions introduced by Grauer and Weil Ltd.

Filtering Solutions

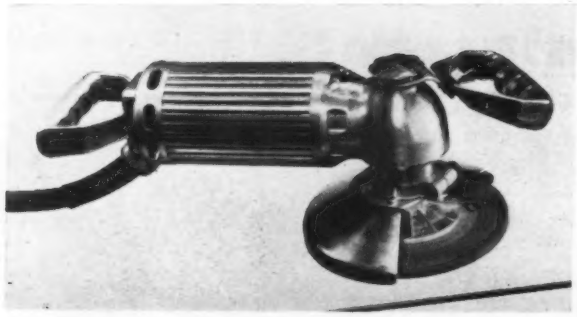
SEDIMENTS of all kinds present in suspension in plating solutions must be continuously removed in order to avoid risk of contaminating the deposited metal coating. Such sediments or impurities may produce pitting or oxidation on the surface of the underlying metal, and render the subsequent polishing particularly difficult. Furthermore, the continuous filtration of plating solutions has now become an absolute necessity.

Grauer and Weil Ltd., Hardwick Street, London, E.C.1, have now introduced two types of apparatus having different filtering areas, and solving practically all the problems of filtration in a normal plating shop.

These two new filters are the "Dever" and the "Teddy," and they ensure perfect retention of all the sediments and impurities present in the plating solution.

The "Dever" filter has a filtering surface of 17½ ft² and a pump capacity of 2,000 gal/hr., with maximum filter capacity of 1,750 gal/hr. This is suitable for plating baths from 450 to 1,350 gal., operating at a maximum temperature of 160°F.

The "Teddy" is similar in design to the "Dever," but has a filtering surface of 8 ft², a pump capacity of 2,000 gal/hr., and a maximum filter capacity of 800 gal/hr. It is suitable for plating



One of the "Sumner" range of high cycle portable tools

baths of 115 to 450 gal., working at a maximum temperature of 160° F.

These filters are robust, durable, easy to maintain, and entirely protected against corrosion, and in a recent test on a bright nickel bath of 875 gal., operating for 24 hr. a day, it was found necessary to clean the filter only once every 1,000 hr.

It is claimed on both models that no alteration is necessary to existing installations in the fitting of this filtration equipment, and tanks over 1,350 gal. can be equipped with several of these filter units.

Portable Grinding

A RANGE of high speed portable power tools is being marketed by Lorant Engineers (London) Ltd., High Street, South Norwood, London, S.E.25, that has high speeds and relatively light weight. These "Sumner" high cycle tools are made in 12 types with 46 variations, working on 42 V. The frequency is 400 cycles, producing a speed of 24,000 r.p.m. Working speeds range from 110 r.p.m. to 40,000 r.p.m.

Due to the smaller weight, the size of the tool is also reduced, and tools can be used with comfort for overhead work; while for angle grinding, drilling and reaming, tools with up to 2,600 W. output are available.

All the tools are housed in light alloy pressure die-castings with two walls. The small squirrel cage motor is totally enclosed within the inner wall, and a large fan supplies a continuous flow of air over the whole area. Small frequency changers with an output from 1 kW to 16 kW are readily available.

Smoke Abatement

COVERING the needs of small and large chimneys, and enabling the requirements of the Clean Air Act to be complied with in the most economical way, a series of smoke alarms and recorders introduced by A. M. Lock and Co. Ltd. Prudential Buildings, 79 Union Street, Oldham, Lancs., includes the following:—

A simple smoke alarm, Type SA1, suitable for chimneys up to 10 ft. in diameter, gives an alarm when the smoke passing up the stack exceeds a preset amount. It can be mounted up to 100 ft. from the light projector and receiver units which are mounted on the stack in weatherproofed housings. Two-alarm recorders are available for use with this simple smoke alarm, a spring driven model which has a chart lasting 24 hr., and an electrically powered one in which the chart lasts seven days.

A smoke density indicator, MF2, provides for remote indication and recording of smoke density, as well as an alarm when "dark smoke" is emitted. Many desirable features are provided on this new equipment, such as a completely interchangeable plug-in electronic chassis in the control unit; robust easily accessible terminal connection panel; dust-tight cast aluminium case of pleasing design, with hinged door, together with a lock and hinged chassis.

The careful mechanical design of the light receiver and projector has even further reduced effects of dust and soot deposits, and an ingenious double hinge arrangement allows easy access to the lamp, photocell and lenses.

Obituary

Mr. A. H. Waine

IT is with regret we record the death of Mr. A. H. Waine, a director of Hadfields Limited and managing director of the subsidiary company Hadfields Forgings Limited. He had been with Hadfields Limited for over 40 years.

Born in Sheffield, Mr. Waine studied at Sheffield University, gaining Associateships in Metallurgy and in Engineering. He was awarded the Mappin Medal in 1930. He became a local director of Hadfields Limited in 1945, joined the board of Hadfields Foundry and Engineering Co. Ltd. in 1948, and was elected to the board of Hadfields in 1950.

Mr. Waine was a Fellow of the Institution of Metallurgists, an Associate of the Institute of Mechanical Engineers, a member of the Iron and Steel Institute, and a member of the Sheffield Society of Engineers and Metallurgists.

Mr. C. J. Ward

WE also regret to record the death of Mr. Christopher John Ward, managing director of the scrap metal firm of C. T. Ward and Sons Ltd., of Cato Street, Birmingham.

STANDARD SPECIFICATIONS

Verification of Testing Machines (*B.S.* 1610, *Part* 1:1958). *Price* 6*s.* 0*d.*

NOW revised for the first time, B.S. 1610, Part 1:1958, "Verification of Testing Machines," was first published in January, 1950.

The revised edition gives a more realistic standard for loads above 50 tons force and the accuracy in this range is now in agreement with the provisions of American and Continental standards. Below this range, greater accuracy is required and to cover this need a section has been added dealing with the requirements for the calibration and the use of elastic proving devices.

This new section covers only those devices in which the load is determined by measurement of the elastic deflection of a loaded member. Measurement by this method may be made by mechanical, electrical, optical or other means of sufficient precision and stability. Included in this section are tables for the grading of elastic proving devices, and also tables for deflection and correction values for variations in temperatures for both the Centigrade and Fahrenheit temperature scale.

Other sections in the revision deal with methods of load verification and verification of machines for tension and compression testing. A table has been added for the grading of tension, tension and compression, and compression machines; this table gives the maximum permissible errors for Grade A, B, and C machine scales.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Research Progress

—*continued from page* 432

they determined is comparable with the 265 hr. figure quoted by Wilms, but which refers not to the onset of recrystallization, but to a much later stage in that process. It is regrettable that neither Wilms nor Auld *et al* were able to couch their results on recrystallization in the form of times for the recrystallization of 50 per cent of the material to occur, since this is generally a much more satisfactory basis of comparison than the times for either the onset or completion of recrystallization—difficult stages to determine with precision.

References

1 G. R. Wilms; *J. Inst. Metals*, 1954-5, **83**, 427.

2 J. H. Auld, R. I. Garrod and T. R. Thomson; *Acta Met.*, 1957, **5** (12), 741.

Industrial News *Home and Overseas*

Annual Luncheon

On Wednesday of last week, at the Savoy Hotel, London, a large company of members and guests of **The British Non-Ferrous Metals Research Association** assembled for the annual luncheon of the association, which was presided over by **Dr. Maurice Cook,** chairman of the Council. The chairman was supported at the top table by the **Rt. Hon. The Earl of Selkirk,** First Lord of the Admiralty; **Sir Cyril Musgrave,** Permanent Secretary to the Ministry of Supply; **His Excellency the Rt. Hon. Sir Eric Harrison,** the Australian High Commissioner; **Sir Frank Lee,** Permanent Secretary, Board of Trade; **Sir John Lang,** Secretary, Board of Admiralty; **Sir Owen Wansbrough-Jones,** Chief Scientist, Ministry of Supply, and many other distinguished guests from Government departments, and the Presidents and chairmen of other professional and trade associations.

After the Loyal Toast had been honoured, the Rt. Hon. The Earl of Selkirk proposed the toast of the Association, and in his reply Dr. Maurice Cook referred to the close association which had been maintained between the B.N.F.M.R.A. and the Admiralty, and also the work of the Association in connection with Government departments, and to the non-ferrous industry as a whole. Dr. Cook also referred to the building extensions to the Association's premises, which were going ahead according to plan, and also to the growing work of the Association.

Dr. Cook also proposed the toast of "The Guests," to which the reply was made by Sir Cyril Musgrave, K.C.B.

New Factory

As a further step in the plans for reorganization and rapid expansion, **British MonoRail Ltd.** have now moved to a new modern factory in Wakefield Road, Brighouse, Yorks. It is understood that the business of the company has more than doubled since last year, and it is expected that the present staff of 180 will be increased to 500 in the next three years.

Materials Handling

One of the interesting exhibits at the recent Mechanical Handling Exhibition held in London was that made by **Lancers Machinery Ltd.,** who were showing for the first time their range of sideloaders. These have been designed specifically to handle long or bulky loads in confined spaces—a 7 ft. 6 in. gangway is standard—whilst at the same time giving rapid operation and safe load handling. The load is conveyed parallel to the direction of travel, and in transit is carried on the whole length of the platform instead of being balanced on two comparatively narrow forks; this stability means that speeds up to 22 m.p.h. can be attained without risk of spilling the load.

Lancer sideloaders transport as well as stack, and our illustration on this page shows a 3-ton sideloader handling palletized copper tubes during one of the many stages in manufacture. These machines were under development and test for five years, and have been in regular production since 1953. They are ruggedly built and are suitable for continuous operation under the most arduous conditions. Such loads as timber, steel sections, pipes, fabrications, crated goods, and also palletized and stillaged materials can be handled by these machines. The power is provided by a Ford 4D diesel engine; transmision, etc., is by Ford, and the hydraulic system by Plessey.

New Premises

It has been announced by **Chamberlain Plant Ltd.,** one of the Chamberlain group of companies, that they have now moved to their new works and offices at Crown Works, Southbury Road, Enfield, Middx. The company handles the sales of the "Staffa" range of mobile and shop cranes, the Jenbach diesel driven compressor, and various other items of contractor's plant.

A Merger

It is learned from Metal Industries Ltd. that two of its wholly-owned engineering subsidiaries, **Fawcett Preston and Co. Ltd.** and **Finney Presses Ltd.,** are to be merged on May 31 next. The combined companies will be known as Fawcett Preston and Co. Ltd. (incorporating Finney Presses). Manufacture is to be concentrated at Bromborough, and the Birmingham works will eventually be closed. The joint selling organization of the two companies (Fawcett-Finney Ltd.) is to cease operations, and in future sales will be handled by the new company.

University Extensions

On Friday of last week, Mr. Clive Cookson, D.C.L., officially opened the extensions to the Metallurgy Department, King's College, Durham University. In these extensions will now be congregated a lecture theatre, metallography section and metallography research, physical metallurgy laboratory, X-ray and spectrography sections, mechanical testing and heat-treatment sections, machine shop, chemical analysis and corrosion sections, a research room, staff rooms, library, and kitchen.

The foundry and certain other teaching rooms have not been accommodated in the new extensions, but it is hoped that adjoining buildings may soon become available so that the whole department, now growing rapidly, may be concentrated within a small convenient area.

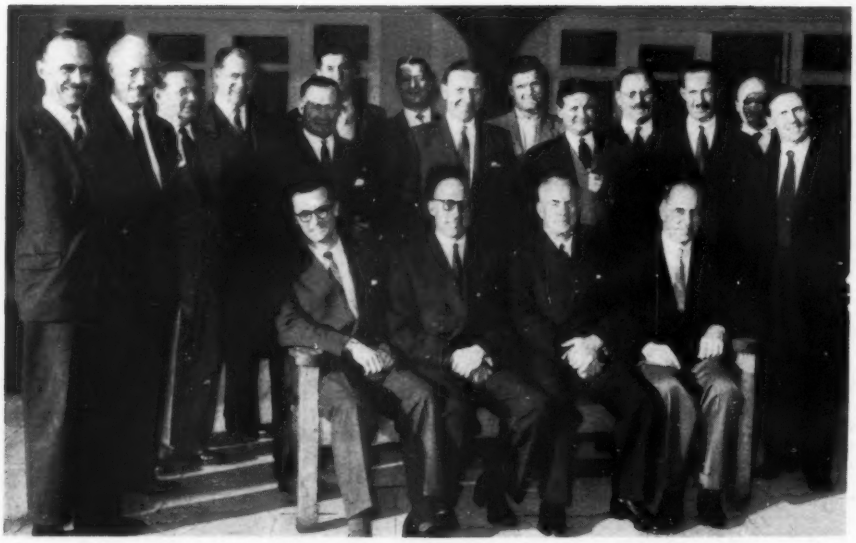
New Furnaces for Railways

British Railways, Midland Region, have placed an order with **Birlec Limited** for two electric arc melting furnaces. It is understood that this will be British Railways' first electric melting equipment. The new furnaces will be installed in the organization's foundry at Crewe and will produce 21 tons of high quality steel daily. Each furnace has a nominal capacity of 3½ tons and an electrical rating of 2,000 kVA.

West German Production

According to preliminary figures issued by the Government's Office of Statistics in Bonn, West Germany's production of non-ferrous metals in the first quarter of this year showed no uniform development but varied in the individual sections of the industry. Production of virgin aluminium amounted to 31,641 tons, compared with 38,271 tons in the same period of 1957. Zinc production was also lower at 44,587 tons, compared with 46,475 tons. Electrolytic copper production was 46,067 tons, compared with 42,662 tons,

Lancer 3 ton Sideloader handling palletized copper tubes during one of the many stages of manufacture



Members of the Midlands section of the Metal Finishing Association at the Copt Heath Golf Club, Knowle, for their Golf Tournament

lead output 44,879 tons, compared with 43,070 tons, and tin output was 644 tons compared with 482 tons.

A Golf Meeting

Members of the Midlands section of the **Metal Finishing Association** held this year's competition for the association's golf challenge cup at the Copt Heath Golf Club, Knowle, on Monday of last week. Playing against bogey, the cup was won by Mr. A. S. Heawood (Verichrome Ltd.), with Mr. G. F. Bate (William Bate Ltd.) and Mr. F. W. Bulpitt (Metal Finishers Ltd.), as runners-up, taking second and third prizes respectively. The meeting was followed by dinner at the Club House.

Efco-Udylite Processes

It has been announced by **Electro-Chemical Engineering Co. Ltd.** that the present arrangements by which R. Cruickshank Ltd. distribute and service Efco-Udylite processes non-exclusively will be discontinued from July 1 next. From this date supplies of addition agents and consumable products, and full technical service, will be available to all users of Efco-Udylite bright nickel and other processes in England, Wales and Northern Ireland from Electro-Chemical Engineering Co. Limited, Sheerwater, Woking, Surrey. The company has depots at Birmingham and at Manchester. Stocks of all such products are held at these depots for distribution to customers in the Midlands and North of England, and immediate delivery can be made.

The Hockley Chemical Co. Limited, Hockley Hill, Birmingham, 18, will act as selling agents in England and Wales of Efco-Udylite processes, and will provide full technical service to users. They will hold stocks of all materials for these processes, and have regular delivery services throughout the country. In Scotland, H. A. Dawson-Bowman, Brisbane House, Rowan Road, Glasgow, S.1, will distribute these products, and resident technical service will be provided to all users of the processes in Scotland.

Linings for Heavy Industry

For providing "bone" in the protective linings and refractories of blast furnaces, dust collectors, and in sinter and coke bunkers, Hexmetal cellular reinforcement is offered by **Causeway Reinforcement Ltd.** Hexmetal is a fabrication of steel-walled honeycomb cells which, when loaded with cement or refractories, combines to provide a lining resistant to temperature variation, abrasion, vibration, corrosion, and impact load.

The makers say that operators of blast furnaces have installed Hexmetal linings in top cones, and in the bends and points of greatest abrasion in the uptakes, and at the bends and straight lengths of downcomer pipes. For this work, a specially designed mix, produced by **Morgan Refractories Ltd.,** is used. The method employed is to affix headed studs at suitable centres on the plates for securing the reinforcement and to take the weight of the lining. The length of the studs is determined by the final thickness of lining required. The first layer of refractory is then applied up to the top of the studs, and the formed Hexmetal is welded to them. The final coat of refractory is then applied to fill the cells of the Hexmetal. This reinforced skin layer provides a surface of great strength.

Hexmetal may also be applied to the lower slopes of bunkers, dust collectors and the like. The reinforcement is attached to the wall of the bunker by welding and filled with concrete to which quartz or other suitable aggregate is added. Very high abrasion resistant qualities are said to have been achieved by this method.

Hexmetal is available in carbon steel, stainless iron, aluminized steel strip, or non-ferrous metals. It is manufactured in various forms and in stock sheets 10 ft. by 3 ft., or cut and formed to special size or shape as required. There is a wide variety of gauges and sizes.

World Tin

It has been announced by the International Tin Council that during January 1958, the world output of tin-in-concentrates was 12,700 long tons, as compared with a monthly average of 15,600 tons for the last quarter of 1957. During February, production fell considerably in the three areas (Indonesia, Malaya and Bolivia) whose figures are available. For these areas the February total was 6,288 tons, as compared with 8,553 tons for January.

World production of tin metal in January was 15,000 tons, as compared with a monthly average of 14,600 tons in the last quarter of 1957. During February, production fell considerably in the main smelting areas. The combined total for Malaya, the United Kingdom and the Netherlands during February was only 8,318 tons, against 11,876 tons during January.

World consumption for the year 1957 is now estimated at 157,000 tons. Consumption during January was 12,200 tons, against a monthly average of 11,900 tons in the last quarter of 1957. U.S. consumption in January rose to 3,950 tons, but was still low; United Kingdom consumption at 1,734 tons showed some revival.

Stocks of tin metal with consumers in the U.S. at the end of January, 1958, were lower at 19,310 tons; stocks of metal in official warehouses in the United Kingdom at the end of March were higher at 18,465 tons.

Exports of tin metal from Malaya have fallen from 6,738 tons in January to 4,863 tons in February, and again to 3,333 tons in March.

The imports of tin metal into the Netherlands for January-February combined included 1,676 tons from the U.S.S.R., while imports of metal into the United Kingdom during February included 710 tons from the U.S.S.R. The transit trade from the U.S.S.R. through the Netherlands in January was 126 tons.

Harwell Reactor School

Advance notice is given of a course on the Control and Instrumentation of Reactors, which is to be held at the Harwell Reactor School from October 6 to 11 this year. The fee for the course will be 25 guineas, exclusive of accommodation. Application forms and further details may be obtained from the Principal, Reactor School, Atomic Energy Research Establishment, Harwell, Berks.

Library Resources

During the years since the war, increasing numbers of people in commerce and industry, as well as in other spheres, have come to feel the need for rapid and reliable information services. In so far as the collection of technical books and information is concerned,

many industrial firms have now built up their own technical libraries, where information can be obtained on many subjects.

So far the attempt to produce an efficient record of such libraries and the type of books and information each contains, has been confined to a few areas. There are several local guides in certain areas and, of course, the large technical libraries attached to municipal authorities are well known for their help in this way. Library resources in the West Midlands have now been collated and published in the form of a 50-page brochure, which should prove invaluable to industrialists and their concerns in the areas covered.

The area included in this new guide is that of the Five Counties of the West Midlands — Herefordshire, Shropshire, Staffordshire, Warwickshire and Worcestershire. Within the area of these counties the aim has been to cover, as far as possible, every type of library with the exception of the branch libraries of municipal and county systems, and the commercially-run circulating library.

After the preface, the guide is divided into sections as follow:—alphabetical section, an appendix, a topographical index, and an index to subjects together with a key to the abbreviations used. Each library is listed under the name of the concern with which it is connected (public authority or industrial firm), its address, staff, availability for reference, number of books, etc., and list of subject matter dealt with. It is interesting to note that under the heading of Metallurgy there are nine libraries to which reference can be made for information, and under Non-ferrous metallurgy there are five centres for information. There are other subjects listed in the general index, such as aluminium, electroplating, foundry practice, galvanizing, heat-treatment, magnesium, metal finishing, nickel, and welding.

Copies of this excellent guide may be obtained (price 15s. post free) from the Hon. Treasurer, West Midlands Group, Reference and Special Libraries Section, The Library Association, Reference Library, Birmingham, 1.

Dividing Tables

A new range of precision dividing tables has recently been introduced by **A. A. Jones and Shipman Ltd.** These tables are for vertical and horizontal mounting, and can be used for fast setting for production work by means of two dividing plates, each having nine rows of holes, giving 20, 32, 38, 39, 44, 46, 49, 52, 56, and 31, 34, 37, 41, 43, 47, 53, 58, 59 divisions. An illustrated leaflet gives concise details of these tables.

Branch Office Moves

Information has been received from **Wild-Barfield Electric Furnaces Ltd.** to the effect that their branch office in Canada has moved to new premises at 77 Grenville Street, Toronto, Ontario. In addition to dealing with Wild-Barfield heat-treatment equipment, this branch is also responsible for sales and service of melting and heat-treatment furnaces made by G.W.B. Furnaces Ltd., and kilns and lehrs manufactured by The Applied Heat Co. Ltd.

Showing at Hanover

It is learned from **Sklenar Furnaces Ltd.** that a great interest was shown in their stand at the Hanover Trade Fair. It is understood that the company's furnace in operation was the only working foundry exhibit on show. The stand consisted of a Type 50/150 gas-fired Sklenar furnace melting small 25 kg. charges of aluminium in 8 min.

The company states that, as a result of this exhibition, their German agents had received many firm enquiries for melting equipment and, in addition, the company has also receved enquiries from overseas visitors to the Fair.

An Annual Meeting

On Thursday evening next, May 29, the annual general meeting of the **Birmingham Metallurgical Society** will be held at 6 p.m. at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham.

N.P.L. Open Days

Visitors to the open days organized last week at the **National Physical Laboratory** at Teddington were given the opportunity of seeing demonstrations of much of the current work being done there. In the field of metallurgy much of the current research is concerned, as would be expected, with problems of fatigue and the mechanical properties of metals. Among the new developments on show were methods of determining the surface and grain boundary energies of copper-antimony alloys, the results indicating that the influence of antimony in promoting grain boundary failure in copper may be largely due to its effect of lowering the surface energy of copper.

Other new work included studies of textures in titanium and its alloys, the effect of adsorption of hydrogen on the structure of niobium, and the formation and aggregation of excess vacancies in brass.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week totalled 18,462 tons, comprising London 5,888, Liverpool 11,384, and Hull 1,190 tons. Copper stocks totalled 16,582 tons, and comprised London 10,659, Liverpool 5,533, Birmingham 215, Manchester nil, Swansea 175, and Hull nil.

Extensions

Additional office space in the new Bucklersbury House, London, has been acquired by **John Miles and Partners (London) Ltd.** to house the expanding consulting engineering and design staff. The present premises in Cannon Street, London, E.C.4, will still be retained.

Die-Casting Press

We learn from **J. V. Murcott Limited,** of Birmingham, that Mr. J. V. Murcott, Mr. A. F. Murcott and Mr. J. E. Smith, who have just returned from Italy, have been visiting the Milan factory of A. Triulzi in order to watch the final assembly and study the method of operation of a new model 25M Triulzi die-casting press which is destined for the Murcott works and is expected to reach Birmingham by the end of June and to be in full production during July.

It is believed that this machine will be the largest of its kind in the United Kingdom, and it can take a charge of 40 lb. of aluminium, with a clamping force of 30 to 1,500 tons. The press itself measures 22 ft. long by 5 ft. by 7 ft., and together with its ancillary equipment the compete unit weighs over 35 tons.

The type of work envisaged for this press includes "one-shot" production of refrigerator doors, gas stove frames, motor cycle frames, large motor cycle crankcases, bicycle frames, motor-car wheels, crankcases, cylinder heads, gearboxes, brake shoes and brake drums for lorries, and heavy electrical and instrument equipment. It is understood that the machine is quite capable of producing a unit weighing 40 lb. every minute.

Development work at Murcott's is a continuous process, and the firm state that they are developing a new method of motor cylinder head production which consists of pressure casting around a core of expendable metal shaped to the dimensions of the internal water passages and ports. When the casting has been made the core metal is then melted out from the centre of the casting. Valve seat and guide inserts can be incorporated and the firm considers that the process has tremendous possibilities.

Bauxite in Western Australia

According to news from Melbourne, Western Mining Corporation Limited proposes to prospect for bauxite in the Darling Ranges — in the south-west of Western Australia. Directors say in the latest quarterly report that the company has been granted a temporary reserve to prospect the area.

A party will soon be in the West Kimberley district to carry out geological and geophysical work on the company's new copper prospect there. The company has a temporary reserve of 2,000 miles^2 in the Kimberleys, where four outcrops, totalling 6,000 ft. long, carrying copper, have been located. Directors say a number of significant copper showings have also been found where creek channels have made exposures in the adjoining plains.

Unsold Nickel Stocks

News from New York is to the effect that The International Nickel Company has reported that stocks of unsold nickel in the hands of the Canadian and United States Governments, producers and consumers on April 30 equalled more than half the total consumed by North America in 1957 for both civilian and defence purposes. The company estimated accumulated nickel stocks at 144 million lb., exclusive of metal in the U.S. Government stockpile, now available to consumers. It put free world nickel production capacity this year at about 525 million lb., up about 35 million lb. a year from last year's level.

In a survey entitled "The Supply of Nickel, 1958-1961," Inco forecast free world capacity in 1959 at 550 million lb., in 1960 about 500 million, and in 1961 at 650 million lb.

Copper in Italy

Statistics released in Rome by the Italian Central Statistical Office show copper imports for the first two months of the current year. Imports of crude copper for refining amounted to 608·3 metric tons, including 101·3 tons imported temporarily. Main suppliers were Chile 506·5 tons, and Indonesia 101·3 tons. Imports of refined copper in slabs, ingots, shot and powder amounted to 12,039·9 metric tons, including 1,601 metric tons of temporary imports. Main sources were the U.K., 1,501·5 tons; Belgian Congo, 1,862·5; Chile, 1,567·4, and the U.S., 3,803·6 metric tons.

Metal Market News

ALL four metals showed a somewhat easier tendency last week, tin being especially off the boil, so much so that the Tin Council were again supporting the market at the floor price of £730. Wall Street, after showing considerable strength during the early part of the week, turned a little uncertain, and the close was below the best. While the settlement of the railway wages dispute was a heartening factor for industry and commerce, the untoward events in France exercised an adverse influence on sentiment. On the London Stock Exchange, a reasonably steady tone prevailed, but business was quiet and rather subdued, with investment buying not much in evidence. The British Non-Ferrous Metals Federation has issued the details of consumption for the month of March which, naturally, show an improvement on February but are not up to the standard of January, except in the case of lead. Consumption of refined copper in March was 41,539 tons, against 37,907 tons in February, the corresponding figures in scrap being 11,532 tons and 13,652 tons. Stocks, at 94,330 tons were up by fully 5,000 tons. In lead, the March usage was 29,713 tons, compared with 27,855 tons in February, while scrap and remelted metal totalled 8,241 tons, against 7,490 tons. Stocks of refined pig lead, which stood at the lowest level seen for many a long day, were 40,547 tons at March 31 compared with 47,738 tons a month earlier. In zinc, consumption at 26,967 tons showed an increase over February of 2,416 tons, while stocks dropped by about 50 tons to 46,608 tons. Consumption of tin at 1,566 tons, of which 53 tons was secondary, showed little change.

London Metal Exchange warehouse stocks of copper continued to decline, last week's report showing a further fall of 500 tons to 17,707 tons. Trading in the copper ring was quiet, the turnover being no more than 5,000 tons including transactions on the Kerb market, and throughout the week the quotation moved within narrow limits. On balance, cash closed 15s. down at £178 5s. 0d., while three months was 10s. off at £180 5s. 0d. No change was seen in the U.S. quotations, but business was reported to be a little better, although activity on the Commodity Exchange has diminished considerably of late. Should the firm tone of the London market continue, it is felt that there is a chance that the custom smelters may raise their price in the near future. On the whole, the outlook for copper appears to be a good deal better than it was, and it is not so easy to find people prepared to operate on the bear tack. Much, of course, depends on how matters develop in the United States during the coming weeks, but it must be confessed that there is little indication of any real change upwards in trade activity, although, as already mentioned, Wall Street has been flying an optimistic banner.

Tin gave way rather badly last week, and the contango narrowed to £3. At the close of business, cash stood at £731, which was £6 down, and three months at £734, or £6 lower than a week earlier. The turnover was 710 tons without Kerb business. Stocks in official warehouses declined by 204 tons to 18,410 tons, which is still substantially above the copper total. It is rather disappointing that the market has slipped back to the support level once more, for there were signs that American buying was developing, and on the whole it did seem as if at long last the policy of limited export quotas was having its effect on the situation. The truth is, however, that the amount of tin coming forward from what might be called unexpected quarters has surprised everybody. Once again the outlook in regard to the price is rather uncertain. Trading in lead was quiet, only about 2,800 tons changing hands, while on balance May dropped by 7s. 6d. and August by 10s. Zinc was more active, but much of the 7,500 tons turnover was represented by carries. Both prompt and forward closed £1 down on balance at £61 7s. 6d. and £61 15s. 0d.

Birmingham

The holiday this week-end for Whitsuntide is likely to be extended at some of the works either in, or associated with, the motor trade. This is due to the continuance of the strike at the body building works at Swindon. The outlook is uncertain, but whether there is an early settlement or not, work on important overseas orders has already been seriously delayed. There is little change in other metal-using industries in the area. The building trade remains rather quiet, and suppliers of builders' brassfoundry and ironfoundry are feeling the effect. A falling-off in work at ordnance factories has brought a drop in consumption of non-ferrous metal, and there is also less work at some of the factories building aircraft.

Consumption of iron and steel is falling slowly in the Midland area. The re-rolling mills are operating a reduced number of shifts because of lack of business in small bars and sections. Stocks of semi-finished steel are higher, and the amount of foreign steel imported continues to decline. The brightest spot in the heavy engineering section is concerned with the production of electrical equipment for power stations in this country and abroad, and order books ensure full employment for the next two or three years. Constructional engineers are seeking new business for the second half of the year, as they have cleared off many of their building contracts.

New York

Few salient features were discernible on the U.S. non-ferrous metal market in the past week. Producer sales of electrolytic continued slow at 25 cents and while custom smelters reported fair sales at 23¾ cents per lb., this slight improvement was not considered of sufficient volume to indicate any change in trend. One leading producer said he looked for no substantial change in copper until the autumn, and then the condition of the economy would determine if any substantial improvement in producer copper sales, which normally entails the preponderant volume of copper business, could be expected.

Trade sources said that sales of copper and brass products for the first quarter of the current year were estimated to be 22 per cent lower than they were during the first quarter of 1957. The drop in wire business was said to be less drastic. Some sources anticipated that sales of copper and brass products for the current year would be off 15 per cent from 1957.

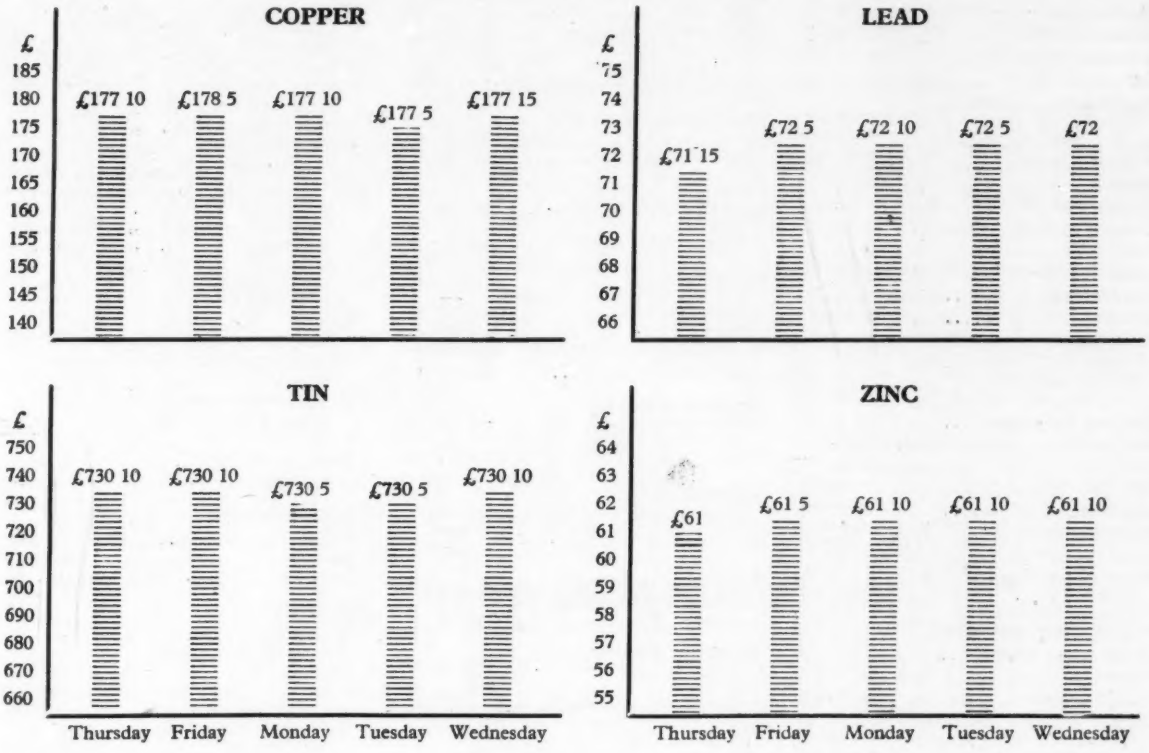
Lead and zinc were also being squeezed by cheaper imports. Traders estimated that it was possible to land foreign lead at about 1 cent cheaper than the domestic metal, and foreign zinc at about ½ to ¾ of a cent below U.S. produced zinc. The inability as yet, of the administration to take positive action on the industry plea for tariff relief, and the sharply divided recommendations of the Tariff Commission induced some pessimism among lead/zinc industry observers. These sources said that it would be difficult for lead to continue at 12 cents, considering the foreign metal selling in the U.S., unless some tariff relief was forthcoming soon.

Although there has been some seasonal improvement in call for lead and zinc, one leading source said that March business was so low it was still too early to judge how much of a seasonal betterment would develop. This executive said he did not look for any real improvement in demand until the fourth quarter. Meanwhile, pressure was mounting for some Government relief for other metals. Mr. R. S. Reynolds, Jnr., President of Reynolds Metal Company, said that the administration's subsidy plan discriminated against aluminium, and he asked that aluminium be added to the list of subsidized metals in the plan.

Tin was firmer on higher foreign markets and seasonally improved U.S. tin plater buying. However, as the prices advanced, plater interest slackened, and prices slipped latterly as platers withdrew from the market.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 15 May 1958 to Wednesday 21 May 1958



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	Canada c/lb ≏ £/ton	France fr/kg ≏ £/ton	Italy lire/kg ≏ £/ton	Switzerland fr/kg ≏ £/ton	United States c/lb ≏ £/ton
Aluminium		22.50 185 17 6	210 182 15	375 217 10		26.10 208 17 6
Antimony 99.0			195 169 12 6	430 249 10		29.00 232 0
Cadmium			1,400 1,218 0	2,550 1,479 0		155.00 1,240 0
Copper						
Crude						
Wire bars 99.9				375 217 10		
Electrolytic	25.25 184 10	24.25 200 7 6	230 200 2 6		2.30 192 7 6	25.00 200 0
Lead		11.00 90 17 6	110 95 15	178 103 5	.93 77 15	11.50 92 0
Magnesium						
Nickel		71.50 590 10		1,330 771 10	7.80 652 5	74.00 592 0
Tin	102.25 747 10		916 797 0	1,400 812 0	8.60 719 2 6	94.50 756 0
Zinc						
Prime western		10.00 82 12 6				10.00 80 0
High grade 99.95		10.60 87 10 0				
High grade 99.99		11.00 90 5				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	155 90 0	.82 68 10	11.25 90 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 12 noon 21/5/58)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		10	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite	per unit		—	
Copper H.C. Electro	ton	177	15	0
Fire Refined 99·70%	„	176	0	0
Fire Refined 99·50%	„	175	0	0
Copper Sulphate	„	66	0	0
Germanium	grm.		—	
Gold	oz.	12	9	4¾
Indium	„		10	0
Iridium	„	26	0	0
Lanthanum	grm.		15	0
Lead English	ton	72	0	0
Magnesium Ingots	lb.		2	5½
Notched Bar	„		2	10½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	300	0	0
Mercury	flask	76	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„	7	10	0
Platinum	„	25	0	0
Rhodium	„	40	0	0
Ruthenium	„	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	4⅛
Tellurium	lb.		15	0
Tin	ton	730	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	61	12	6
Dust 95/97%	„	104	0	0
Dust 98/99%	„	110	0	0
Granulated 99+%	„	86	12	6
Granulated 99·99+%	„	99	8	9

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0

†**Aluminium Alloy (Secondary)**		£	s.	d.
B.S. 1490 L.M.1	ton	154	10	0
B.S. 1490 L.M.2	„	161	10	0
B.S. 1490 L.M.4	„	183	0	0
B.S. 1490 L.M.6	„	204	0	0

†Average selling prices for March

***Aluminium Bronze**				
BSS 1400 AB.1	ton	199	0	0
BSS 1400 AB.2	„	215	0	0
***Brass**				
BSS 1400-B3 65/35	„	129	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„	170	0	0
***Gunmetal**				
R.C.H. 3/4% ton	ton		—	
(85/5/5/5)	„	153	0	0
(86/7/5/2)	„	163	0	0
(88/10/2/1)	„	210	0	0
(88/10/2/½)	„	222	0	0
Manganese Bronze				
BSS 1400 HTB1	„	162	0	0
BSS 1400 HTB2	„		—	
BSS 1400 HTB3	„		—	
Nickel Silver				
Casting Quality 12%	„		nom.	
„ „ 16%	„		nom.	
„ „ 18%	„		nom.	
***Phosphor Bronze**				
2B8 guaranteed A.I.D. released	„	240	0	0
Phosphor Copper				
10%	„	212	0	0
15%	„	220	0	0

**Average prices for the last week-end.*

Phosphor Tin				
5%	ton		—	
Silicon Bronze				
BSS 1400-SB1	„		—	
Solder, soft, BSS 219				
Grade C Tinmans	„	345	3	0
Grade D Plumbers	„	279	3	0
Grade M	„	378	0	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9	„		—	
Zinc Alloys				
Mazak III	ton	92	13	9
Mazak V	„	96	13	9
Kayem	„	102	13	9
Kayem II	„	108	13	9
Sodium-Zinc	lb.		2	5

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			£	s.	d.
Sheet 10	S.W.G.	lb.		2	8
Sheet 18	S.W.G.	„		2	10
Sheet 24	S.W.G.	„		3	1
Strip 10	S.W.G.	„		2	8
Strip 18	S.W.G.	„		2	9
Strip 24	S.W.G.	„		2	10½
Circles 22	S.W.G.	„		3	2
Circles 18	S.W.G.	„		3	1
Circles 12	S.W.G.	„		3	0
Plate as rolled		„		2	7½
Sections		„		3	1½
Wire 10	S.W.G.	„		2	11
Tubes 1 in. o.d. 16 S.W.G.		„		4	0

Aluminium Alloys			£	s.	d.
BS1470. HS10W.		lb.			
Sheet 10	S.W.G.	„		3	0½
Sheet 18	S.W.G.	„		3	3
Sheet 24	S.W.G.	„		3	10½
Strip 10	S.W.G.	„		3	0½
Strip 18	S.W.G.	„		3	2
Strip 24	S.W.G.	„		3	10
BS1477 HP30M. Plate as rolled		„		2	10½
BS1470. HC15WP.					
Sheet 10	S.W.G.	lb.		3	6½
Sheet 18	S.W.G.	„		4	0½
Sheet 24	S.W.G.	„		4	10½
Strip 10	S.W.G.	„		3	9½
Strip 18	S.W.G.	„		4	0½
Strip 24	S.W.G.	„		4	8
BS1477. HPC15WP. Plate heat treated		„		3	5½
BS1475. HG10W. Wire 10	S.W.G.	„		3	9½
BS1471. HT10WP. Tubes 1 in. o.d. 16 S.W.G.		„		4	11
BS1476. HE10WP. Sections		„		3	1
Beryllium Copper					
Strip		„	1	4	11
Rod		„	1	1	6
Wire		„	1	4	9
Brass Tubes		„		1	5⅜
Brazed Tubes		„		—	
Drawn Strip Sections		„		—	
Sheet		ton		—	
Strip		„		—	
Extruded Bar		lb.		1	8½
Extruded Bar (Pure Metal Basis)		„		—	
Condenser Plate (Yellow Metal)		ton	147	0	0
Condenser Plate (Naval Brass)		„	158	0	0
Wire		lb.		2	2½
Copper Tubes		lb.		1	8½
Sheet		ton	205	10	0
Strip		„	205	10	0
Plain Plates		„		—	
Locomotive Rods		„		—	
H.C. Wire		„	226	15	0
Cupro Nickel					
Tubes 70/30		lb.		3	2⅜
Lead Pipes (London)		ton	115	5	0
Sheets (London)		„	113	0	0
Tellurium Lead		„	£6 extra		
Nickel Silver					
Sheet and Strip 7%		„		3	3
Wire 10%		„		3	9½
Phosphor Bronze					
Wire		„		3	6⅛
Titanium (10,000 lb. lots)					
Billet 11″-4″		lb.	69/-	60/-	
Wire ·315″-·036″		„	101/-	201/-	
Sheet (4′/8′ × 2′) ·160″-·010″		„	100/-	158/-	
Strip ·048″-·003″		„	100/-	350/-	
Tube Representative gauge		„	320/-		
Extrusions		„	137/-		
Zinc Sheets, English destinations		ton	95	10	0
Strip		„	nom.		

Financial News

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of March, 1958, have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follow in long tons:—

COPPER	Gross Weight	Copper Content
Wire	22,924	22,550
Rods, bars and sections	12,543	8,327
Sheet, strips and plate	12,426	9,907
Tubes	6,600	6,048
Castings and miscellaneous	6,906	—
Sulphate	2,327	—
	63,736	53,071
Of which:		
Consumption of Virgin Copper		41,539
Consumption of Copper and Alloy Scrap (Copper Content)		11,532

ZINC	
Galvanizing	6,966
Brass	8,865
Rolled Zinc	1,962
Zinc Oxide	2,493
Zinc Die-casting alloy	4,754
Zinc Dust	1,003
Miscellaneous Uses	924
Total, All Trades	26,967
Of which:	
High purity 99·99 per cent	5,148
Electrolytic and high grade 99·95 per cent	5,096
Prime Western, G.O.B. and de-based	8,978
Remelted	407
Scrap Brass and other Cu alloys	4,509
Scrap Zinc, alloys and residues	2,572

ANTIMONY	
Batteries	123
Other Antimonial Lead	49
Bearings	29
Oxides—for White Pigments	103
Oxides—other	85
Miscellaneous Uses	14
Sulphides	4
Total Consumption	407
Antimony in Scrap	
For Antimonial Lead	415
For Other Uses	13
Total Consumption	428

LEAD	
Cables	9,096
Batteries	2,776
Battery Oxides	2,684
Tetra Ethyl Lead	1,790
Other Oxides and Compounds	2,388
White Lead	744
Shot	376
Sheet and Pipe	5,122
Foil and Collapsible Tubes	402
Other Rolled and Extruded	464
Solder	1,221
Alloys	1,591
Miscellaneous Uses	1,059
Total	29,713

CADMIUM	
Plating Anodes	39·40
Plating Salts	5·35
Alloys: Cadmium Copper	3·80
Alloys: Other	3·45
Batteries: Alkaline	1·45
Batteries: Dry	0·30
Solder	5·10
Colours	21·35
Miscellaneous Uses	1·85
Total Consumption	82·05

TIN	
Tinplate	693
Tinning:	
Copper Wire	55
Steel Wire	9
All other	60
Solder	144
Alloys	461
Foil and Collapsible Tubes, etc.	43
Tin Compounds and Salts	96
Miscellaneous Uses	5
Total Consumption	1,566

Venesta Limited

The attention of the board of Venesta Limited has been drawn to continuing reports that a bid is about to be made for the Ordinary shares of the company. They wish to state that no offer or approach of any kind has been made to them, nor have they any reason to expect one.

Harrison (Birmingham) Ltd.

Group net profit £82,813 (£48,407) and distribution 15 per cent, tax free (same). Fixed assets £542,224 (£498,560), current assets £1,412,268 (£1,509,879) and liabilities £358,829 (£434,918). Revenue reserves £910,974 (£917,397) and future tax £89,005 (£79,560).

Associated Lead Manufacturers

Interim dividend, free of tax, for 1957 of £450,000 (same). No further dividend is being recommended. Profit £935,000 (£1,053,000), less tax £457,000 (£627,000). Net profit £478,000 (£426,000). Forward £304,000 (£276,000).

H. J. Enthoven and Sons

Consolidated loss 1957 £156,334 (£29,281). Tax (refund) £2,200 (£8,510). From general reserve £40,000 (£49,800). No dividend on Ordinary (same), forward £37 (£116,518).

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 20/5/58.

	£
Aluminium	
New Cuttings	143
Old Rolled	120
Segregated Turnings	89
Brass	
Cuttings	114
Rod Ends	111
Heavy Yellow	97
Light	92
Rolled	106
Collected Scrap	94
Turnings	105
Copper	
Wire	154
Firebox, cut up	154
Heavy	147
Light	142
Cuttings	154
Turnings	139
Braziery	121
Gunmetal	
Gear Wheels	150
Admiralty	150
Commercial	127
Turnings	122
Lead	
Scrap	64
Nickel	
Cuttings	—
Anodes	500
Phosphor Bronze	
Scrap	127
Turnings	122
Zinc	
Remelted	53
Cuttings	39
Old Zinc	30

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£156.12.6)	180
Heavy copper	(£152.5.0)	175
Light copper	(£130.10.0)	150
Heavy brass	(£100.0.0)	115
Light brass	(£69.12.6)	80
Soft lead scrap	(£57.10.0)	66
Zinc scrap	(£39.2.6)	41
Used aluminium unsorted	(£87.0.0)	100
France (francs per kilo):		
Copper	(£193.2.6)	222
Heavy copper	(£193.2.6)	222
Light brass	(£143.10.0)	165
Zinc castings	(£67.0.0)	77
Tin	(£565.10.0)	650
Aluminium pans (98½ per cent)	(£130.10.0)	150

Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£188.10.0)	325
Aluminium copper alloy	(£101.10.0)	175
Lead, soft, first quality	(£84.2.6)	145
Lead, battery plates	(£49.7.6)	85
Copper, first grade	(£174.0.0)	300
Copper, second grade	(£162.10.0)	280
Bronze, first quality machinery	(£177.0.0)	305
Bronze, commercial gunmetal	(£148.0.0)	255
Brass, heavy	(£124.15.0)	215
Brass, light	(£113.2.6)	195
Brass, bar turnings	(£121.17.6	210
New zinc sheet clippings	(£55.2.6)	95
Old zinc	(£40.12.6)	70

THE STOCK EXCHANGE

Business Continued On Limited Scale But Markets Mainly Firm

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 20 MAY +RISE —FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	20/6	10	10	9 15 0	20/6	17/9	28/3	18/–
400,000	2/–	Anti-Attrition Metal	1/6	4	8½	5 6 9	1/6	1/3	2/6	1/6
23,639,483	Stk. (£1)	Associated Electrical Industries ...	47/6 —9d.	15	15	6 6 3	51/–	47/–	72/3	47/9
1,590,000	1	Birfield Industries	47/9 —6d.	15	15	6 5 9	53/9	47/9	70/–	48/9
3,196,667	1	Birmid Industries	61/– +3d.	17½	17½	5 14 9	65/6	56/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	28/6	10	8	7 0 3	28/6	23/9	33/–	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/4½	5	5	6 10 0	15/7½	14/7½	16/–	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/7½	6	6	7 4 3	17/–	16/6	19/–	16/6
500,000	1	Bolton (Thos.) & Sons	26/3	12½	12½	9 10 6	28/9	26/3	30/3	28/9
300,000	1	Ditto Pref. 5%	15/3	5	5	6 11 3	16/–	15/3	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	19/3	7	7	7 5 6	19/3	19/–	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.	37/–	12	12	6 9 9	46/6	37/–	72/–	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	19/–	6	6	6 6 3	19/3	18/4½	21/6	18/–
15,000,000	Stk. (£1)	British Insulated Callender's Cables	42/6xd +10½d.	12½	12½	5 17 6	44/3	38/10½	55/–	40/–
17,347,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	33/7½ +1/4½	10	10	5 19 0	35/3	29/–	39/–	29/6
600,000	Stk. (5/–)	Canning (W.) & Co.	20/– +1½d.	25+*2½C	25	6 5 9	21/–	19/10½	24/6	19/3
60,484	1/–	Carr (Chas.)	2/– —1½d.	25	25	X8 15 0	2/3	2/–	3/6	2/1½
150,000	2/–	Case (Alfred) & Co. Ltd.	4/3 —1½d.	25	25	11 15 3	4/9	4/3	4/6	4/–
555,000	1	Clifford (Chas.) Ltd.	17/–	10	10	11 15 3	17/–	16/–	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/10½	6	6	7 11 3		—	17/6	16/–
250,000	2/–	Coley Metals	3/3 —6d.	25	25	15 7 9	4/6	3/3	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	43/9xd	18‡	22½	8 11 6	51/6	43/–	92/6	49/–
1,136,233	1	Davy & United	48/9	15	12½	6 3 0	48/9	45/9	60/6	42/6
2,750,000	5/–	Delta Metal	18/– +4½d.	30	*17½	8 6 9	21/4½	17/7½	28/6	19/–
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	32/– +1/6	12½	15B	7 16 3	33/–	24/–	38/6	25/–
750,000	1	Evered & Co.	28/–xcap	15	15	7 2 9	28/–	26/–	52/9	42/–
18,000,000	Stk. (£1)	General Electric Co.	30/– —6d.	12½	14	Y7 13 3	38/7½	29/6	59/–	38/–
1,250,000	Stk. (10/–)	General Refractories Ltd.	32/–	20	17½	6 5 0	33/9	27/3	37/–	26/9
401,240	1	Gibbons (Dudley) Ltd.	66/– +1/–	15	15	4 11 0	66/3	64/–	71/–	53/–
750,000	5/–	Glacier Metal Co. Ltd.	6/– —3d.	11½	11½	9 11 9	6/3	5/7½	8/1½	5/10½
1,750,000	5/–	Glynwed Tubes	13/4½	20	20	7 9 6	13/6	12/10½	18/–	12/6
5,421,049	10/–	Goodlass Wall & Lead Industries ...	22/4½ +1/–	13‖	18Z	5 16 3	22/4½	19/3	37/3	28/9
342,195	1	Greenwood & Batley	46/9	17½	17½	7 9 9	46/10½	45/–	50/–	46/–
396,000	5/–	Harrison (B'ham) Ord.	11/10½xd +6d.	*15	*15	6 6 3	12/4½	11/6	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	18/9	7	7	7 9 3		—	22/3	18/7½
1,075,167	5/–	Heenan Group	7/3	10	20‡	6 18 0	7/7½	6/9	10/4½	6/9
142,045,750	Stk. (£1)	Imperial Chemical Industries ...	44/– +3d.	12Z	10	5 9 0	44/10½	36/6	46/6	36/3
33,708,769	Stk. (£1)	Ditto Cum. Pref. 5%	16/– —3d.	5	5	6 5 0	17/1½	16/–	18/6	15/6
14,584,025	**	International Nickel	135‡ —1‡	$3.75	$3.75	4 19 0	144‡	134	222	130
400,000	5/–	Jenks (E. P.), Ltd.	7/9	27½φ	27½	8 17 6	7/9‡	6/9	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3	5	5	6 3 0	16/3	15/–	17/–	14/6
3,987,435	1	Ditto Ord.	43/6 —6d.	10	9	4 12 0	44/6	37/6	58/9	40/–
600,000	10/–	Keith, Blackman	16/3	15	15	9 4 6	16/3	15/–	21/9	15/–
160,000	4/–	London Aluminium	3/–	10	10	13 6 9	4/3	3/–	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord. ...	43/– +1/–	12½	12½	5 16 3	43/9	39/9	54/6	41/–
400,000	1	Ditto Pref.	22/3	7½	7½	6 14 9	22/9	22/3	25/3	21/9
765,012	1	McKechnie Brothers Ord.	32/–xd	15	15	9 7 6	35/–	32/–	48/9	37/6
1,530,024	1	Ditto A Ord.	30/9xd —1½d.	15	15	9 15 0	32/6	30/–	47/6	36/–
1,108,268	5/–	Manganese Bronze & Brass	9/6xd —4½d.	20	27½‡	10 10 6	10/6	9/–	21/10½	7/6
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–xd	7½	7½	7 10 0	6/3	5/9	6/6	5/–
13,098,855	Stk. (£1)	Metal Box	49/6 +1/–	20‡	15M	4 0 9	49/6	41/9	59/–	40/3
415,760	Stk. (2/–)	Metal Traders	6/10½	50	50	14 11 0	6/10½	6/3	8/–	6/3
160,000	1	Mint (The) Birmingham	20/– —1/9	10	10	10 0 0	22/9	20/–	25/–	21/6
80,000	5	Ditto Pref. 6%	81/6	6	6	7 7 6	83/6	81/6	90/6	83/6
3,064,930	Stk. (£1)	Morgan Crucible A	38/6 —6d.	10	11	5 4 0	40/–	34/–	54/–	35/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref.	17/–	5½	5½	6 9 6	17/3	17/–	19/3	16/–
2,200,000	Stk. (£1)	Murex	54/6 +3d.	20	20	7 6 9	57/6	53/3	79/9	57/–
469,000	5/–	Ratcliffs (Great Bridge)	7/3	10	10	6 18 0	7/3	6/10½	8/–	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	27/–	27½D	27½	6 15 9	27/–	26/–	41/–	24/9
1,365,000	Stk. (5/–)	Serck	12/7½ +6d.	17½Z	15	4 12 6	12/7½	11/–	18/10½	11/6
600,400	Stk. (£1)	Stone (J.) & Co. (Holdings)	43/9	16	16	7 6 6		—	57/6	43/9
600,000	1	Ditto Cum. Pref. 6½%	20/–	6½	6½	6 10 0	20/9	20/–	21/9	18/9
14,494,862	Stk. (£1)	Tube Investments Ord.	53/–xd +2/–	15	15	5 13 3	54/6	48/4½	70/9	50/6
41,000,000	Stk. (£1)	Vickers	30/6xd +9½d.	10	10	6 11 3	32/6	29/4½	46/–	29/–
750,000	Stk. (£1)	Ditto Pref. 5%	15/–	5	5	6 13 3	15/6	14/9	18/–	14/–
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	21/3 —3d.	*5	*5	7 4 9A	23/–	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	73/3	20	15	5 9 3	76/3	70/9	83/–	64/–
2,666,034	Stk. (£1)	Westinghouse Brake	38/– +3d.	10	18P	5 5 3	38/–	32/6	85/–	29/1½
225,000	2/–	Wolverhampton Die-Casting ...	7/1½ —4½d.	25	40	7 0 3	8/–	7/1½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	17/3	27½	27½	7 19 6	17/7½	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	3/6	20	17½E	14 5 9	3/9½	3/3	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	11/6	6	6	10 8 9		—	12/6	11/3
150,000	1/–	Zinc Alloy Rust Proof	2/10½	40D	33½	9 5 6	3/1½	2/7½	5/–	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting **Shares of no Par Value. ‡ and 100% Capitalized Issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. M and 10% capitalized issue. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/– per share or £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. φ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits.